Hellenic Association for Information and Communication Technologies in Agriculture, Food and Environment (HAICTA)

HAICTA 2015

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Proceedings

17-20 September 2015
Kavala, Greece
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Editors
Zacharoula Andreopoulou
Dionysis Bochtis

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PROCEEDINGS

HAICTA 2015

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ΟΠΕΚΕΠΕ

Editorial

The booming of ICTs in all aspects of human life has significantly re-structured the current socio-economic environment with the provision of innovation. Various new technologies have recently emerged in the convergence of different IT-systems aiming to meet the needs of the modern society in goods and services while protecting the environment. Moreover, technology is now transforming in digitization of equipment, of processes, of structures and of business models that provide huge opportunities to those engaged in the agrifood sector, in the protection and preservation of the environment, and in sustainable development and rural planning.

In that context, ICT related research applications, innovative methodologies and practices have been presented and discussed during the 7th International Conference on Information and Communication Technologies in Agriculture, Food, and Environment (HAICTA 2015).

These proceedings contain peer reviewed research papers accepted for presentation at HAICTA 2015, which was held on September 17-20, 2015, in Kavala, Greece.

HAICTA 2015 constitutes a leading bi-annual international professional and scientific forum for IT-experts, geotechnical and agrifood scientists, environmentalists, foresters, water engineers, spatial engineers, and decision-makers, to present research works, contributions and recent developments, current practices and innovations, to suggest questions and issues, and to start a productive debate. Furthermore, another emphasis is put on the applicability of ICT solutions to real industry cases and the respective challenges.

129 papers were initially submitted from scientists from 21 countries. After a double blind review process by at least two members of the Program Committee of HAICTA 2015, 108 papers were finally accepted for presentation and publication in the conference proceedings (83.7% acceptance rate). The included papers highlight new tools, techniques and processes critical for the enhancement of agrifood and environment through information and communications technologies. Most of the papers represent academic research viewpoints while they equally discuss contemporary technologies, emerging research applications and future potential.

These proceedings merge agricultural, food and environmental sector topics with modules of Information Technology aiming to establish successful communication channels, essential for sustainable decision making in agriculture, food and the environment which consecutively contribute to productivity, competitiveness and sustainable development.

The Hellenic Association for Information and Communication Technologies in Agriculture, Food and Environment (HAICTA) marks this year 18 years of existence; the first conference took place in 2002. The conference's prestige grew over the years -mainly from an organizational aspect- arousing the interest of national and international institutions to become conference partners.

We would like to thank the authors and HAICTA participants for their contribution to these proceedings and who continue to participate in HAICTA scientific community. We would also like to thank the reviewers, members of the Programme Committee, for ensuring the Proceedings quality. We are also grateful to the invited keynote speakers Prof. Remigio Berruto, Dr. Nicolai Fog Hansen and Prof. Panos Pardalos, who agreed to share their ideas and research with HAICTA community through their inspired lectures. We would also like to thank the Organizing Committee Chairs, Conference Chairs and Conference Secretariat for their continuous help to our task.

We hope that these proceedings will promote the HAICTA focal scientific areas and contribute the challenges for the integration of innovative and advanced ICT technology, practices and emerging research applications towards environmental and agricultural sustainable development systems while it will enhance a constructive discussion within the scientific community.

The Editors,

Prof. Zacharoula Andreopoulou

Aristotle University of Thessaloniki

Prof. Dionysis Bochtis

Aarhus University

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Doctoral Consortium

Design and Development of a Dynamic Portal – Travel Guide for the City of Florina Concerning Smart Portable Devices

Dimitris Solakis[1], Panagiotis Lefakis[2]

[1]MSc in Applied Informatics, University of Macedonia, Greece, e-mail: jimsols@yahoo.com
[2]Department of Forestry and Natural Environment, Aristotle University of Thessaloniki, e-mail: plefakis@for.auth.gr

Abstract. In the present work, an attempt was made to understand the user some basic concepts such as context with emphasis on location, the context - awareness, the GeoLocation, the mobile computing and some typical applications. Moreover, the user will be able to understand how the system was designed and implemented, what requirements posed by the user, the user interface and system evaluation. Because free software and free services on the Internet were used, such as Google Maps API, the final user is able to reproduce and extend this system, using the source code in its development. For programming mainly we have used the HTML language, PHP, MySQL, JavaScript, KML and we have extensive reference to all languages and technologies used.

Keywords: Context, location , context – awareness, GeoLocation , Mobile Computing, Google Maps, API, HTML, PHP, MySQL, JavaScript, KML, SQL, Database

1 Introduction

Everyone who is being in a new place, visitor - tourist or for other purposes, wish to visit the landscapes and attractions of this place, and navigate quickly and easily to different points of interest within the city. This paper tries to fill in a friendly and interesting way this gap, allowing the user to access any online features, navigate to various points of interest and arrange a visit to the place in the best possible way.

For the implementation of the work was based on several methodologies and technologies such as context and Location Based Services, which are used in other similar applications, but not the same.

The etymology of the word context refers to a situation where different events occur. This concept relates to the current situation that is perceived by humans because of observed events. The Dey and Abowd define context as "any information that can be used to describe the status of an entity" [2].

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According to A.Dey and G.Abowd, a system is context-aware if it uses context to provide relevant information or services to the user, the relevance of which depends on the user's task [1].

«Geolocation» is the recognition of the geographical position of an object in the real world, such as a mobile phone or any other device that can connect to the internet. The Geolocation API allows the user to share its position at trusted sites [4].

The «Google Maps API» is a Javascript API, enabling the incorporation of simple websites without special requirements on the part of the server. With its use, it is possible to incorporate a GoogleMap to an external site, at the site where the data can be superimposed [5].

"Geocoding» (Geocoding) is the process of converting addresses to geographic coordinates, which you can use to place markers or Map locations [6].

«Mobile Computing» is the ability to use technology to remote or mobile (not static) environments [7] [2].

As «Location Based Services» defines the services that depend on the location information of a mobile device. The position information is used to filter out irrelevant information and provide context (context) for different services [3].

Indicative some applications based on context-aware and the location information (location-awareness) are: Guide, Conference Assistant, Active Campus, Place Lab, Smart system for providing wireless service in the airport environment [8].

Internet applications that use the Geolocation are: Mozilla Firefox, Fire eaglem, LOKI, GoogleMaps, Google Earth and other Earth browsers

Mobile - Smartphone applications: Foursquare, Gowalla, Veladia, Yelp, Facebook Places, Brightkite, Loopt, MobiFriends.

2 Aim of the Study

The work aims to implement a system which will utilize the position of the user and in combination with other saved locations of various environmental and not point in the city of Florina, will provide the user with general and specific information.

This system is new, innovative, readily available and accessible to all, is visible to everyone at all times and it concerns the city of Florina. The idea of the work and its substantial contribution is the service, convenience and information browsing and finding sites in Florina and appeals to visitors, tourists, students, and not only, visiting the town of Florina for bit or will stay in this for some time. An effort is made so that the user can escape from the old and outdated instruments in the difficult tour of Florina as simple printed map of the city showing only roads and some illustrative points.

The purpose of the process is to allow any user at any time having an internet connection with the device (eg mobile phone), updated with a nice and easy way for the events that will take place in this place and how long, to see and identify where it is on the map at any time, and points of interest, such as: locations - parks, museums, churches, campuses, banks - ATM, etc.

3 Materials and Methodology

3.1 Materials

The system consists of a central server that stores the data from all sites in a database. Then, the user connects to the central server via the Internet or from the desktop, via a Broadband ADSL connection, either a laptop or mobile phone via wireless (Wi-Fi Hot-Spot) of Florina Municipality and draws Data wishes.

The system was designed and implemented to display locations (points on Google Map) on a portable device (mobile phone), depending on the desire and user options. In more detail:

Improving city tour of Florina: Easy to use, Effectively, Saving time, minimizing the possibility of user's deviation from the procedure.

Modern travel guide: Tour in Florina, Find points of interest, such as locations - parks, campuses, museums, banks, public services, entertainment etc.

«Smart Map», which is much more convenient, replace the print simple map and adapted to each user. Adaptation Aid for young students or people who visit and stay for a while in the city.

3.2 Methodology

For the implementation of the system combined several technologies, which were implemented on many platforms. The embodiments were internet (web) to be available then (24 hours all year round) and accessible by all (figure1).

Detailed description of the technologies found at references. Phrases is primarily using the following technologies: php, mysql, javascript, html, Kml, Geolocation, Timeline, GPS.

Originally acquired space on the Internet for "free web hosting» (free hosting web), was selected and used 000webhost.com. Opened space with special domain within the servers of, http://florinorama.comli.com/. Through the control panel is managing MySQL Databases (via phpMyAdmin) and the File Manager we can upload files to use and beyond. In the system used html, php and kml files.

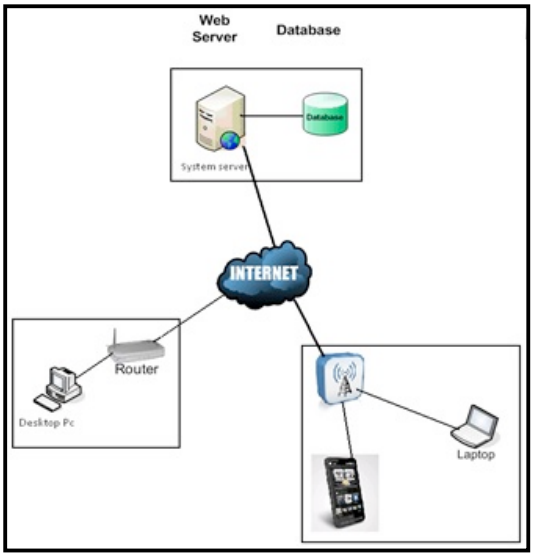

Fig 1. The structure of the information system.

To make the system easy to use but also to meet the requirements set, such as writing a new user and a new Administrator, their entry into the system, the uniqueness of their account, search for locations, adding new and delete old and the emergence, modification and deletion of data users and management, use of a database, which contains four tables, as seen in Figure 2.

The first two («users» and «admins») include details of users and administrators. Specifically initially contain the ID name and the user name or the Manager, the email will be declared and the username and password.

The first table is the «placemark» and contains the details of each Pin that we have built and meets at point (a location on the map) of the city of Florina, such as ID, name, style, coordinates - coordinates (longitude & latitude) and a description of what this point. The other table is the «tag» and includes the name of the tag and Placemark of (tag).

With these two tables and a code in php programming language and queries in SQL (MySQL uses the 000webhost server), can be stored a Pin from the map in the database and back to display on the map Pin we have stored. Moreover, because the components of the Placemarks in the database we want to be used in portable devices (mobile phone, laptop, netbook) but at the same time can be processed by the Google Map or Google Earth, KML technology used and the corresponding files, as shown in Figure 3.

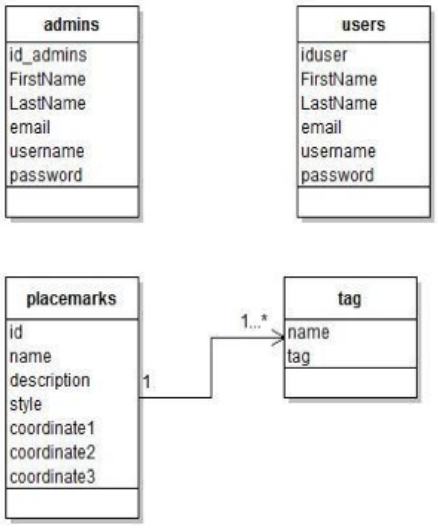

Fig 2. The database of the system.

Fig 3. KML file

Example of a file KML:

```
<? Xml version = "1.0" encoding = "UTF-8"?>
<Kmlmlns = "http://www.opengis.net/kml/2.2">
<Placemark>
  <Name> New York City </ name>
  <Description> New York City</ description>
   <Point>
    <Coordinates>-74.006393,40.714172,0
    </ coordinates>
     </ Point></ Placemark></ kml>
```

Then, we present the data flow diagrams and activities to be better understood by the system (Figures 4 and 5). Regarding the system data flow diagram for the user, it is worth mentioning that the system starts with the user's entry (login). Immediately after, the user is informed for the various events taking place in the city of Florina. The system detects the "position" of the user and urges him to choose one category from the available, which include the points outlined by category. The system communicates with the database and displays the results (how many points found for this category). The user can then use the information (via File KML) on his phone with the Google Map for Mobile program or computer, the Google Map application online. At the same time, but to view the information on the map, but it can process them. Diagram activities, figure 5, we see that the system has a beginning, middle and end. It starts with sightseeing in internal and external links, calls to make logging in, if already registered, otherwise encourages him to enroll in the system. Then informs the user (for events taking place in the city of Florina), the system detects the location of the user and the end user can select a category to be offered to the information they want at any time. Immediately after, we see that the system enables multiple options to the user.

The user can either download the KML file (which contains the information of points of the class chosen) and to use his mobile phone (through the application Google Map for Mobile) and the computer from the Google Map web application or to simply see the map points category chosen.

The user is following the flow of the system may, if desired, choose another category or else again to make disconnect and exit the system.

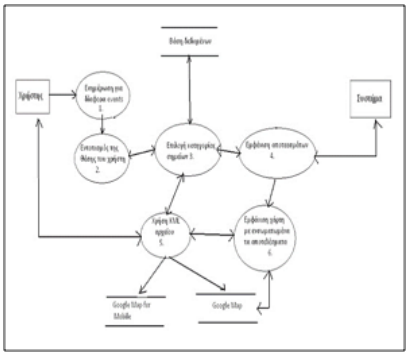

Fig 4. Flow chart for the user.

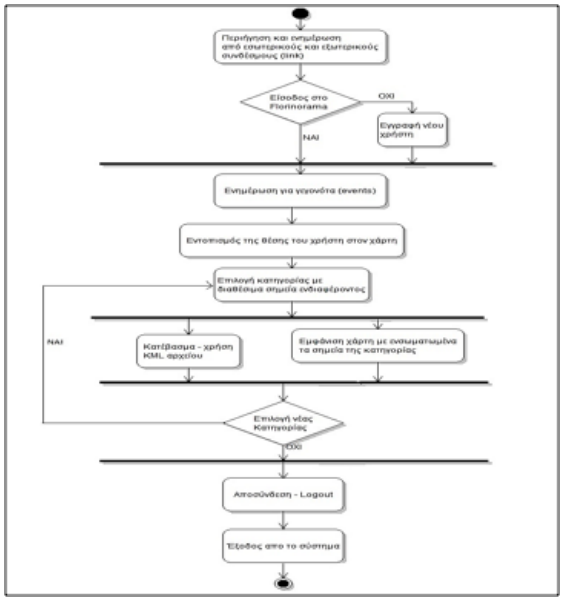

Fig 5. The activity diagram.

4 Results

By typing in the address bar a browser email address http://florinorama.comli.com/ appears homepage FLORINORAMA. On the home page provides some general information on what is FLORINORAMA.
The system can use three types of users:
1. Guest,

2. User (registered user to FLORINORAMA)
3. Administrator

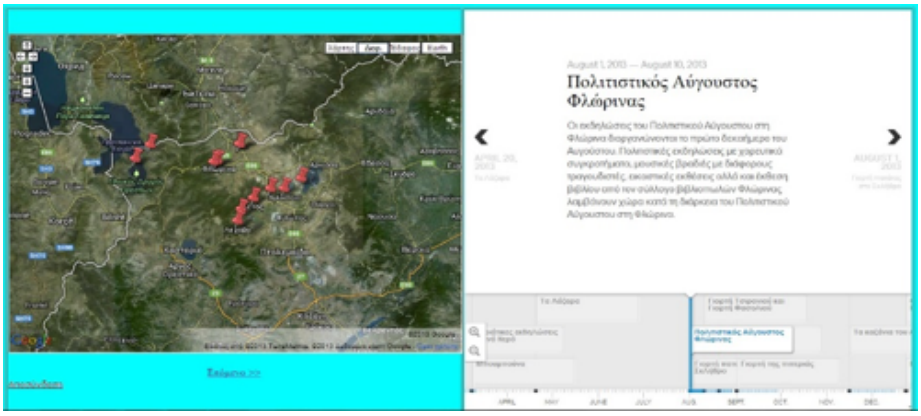

Fig 6. First view with the map and timeline.

Detailed description of system pages for the three categories you can find in [8] References in Chapter 4. Examples presented with images the timeline and identify the position.

By entering FLORINORAMA (Figure 6), the user switches to the page, where there is a Google Map includes some illustrative Placemark and next to the map is a timeline bar, in which the system administrator adds several facts from more simply, as when the Placemark added, paths and polygons to and played some events, how long does an event happened and the duration of this event.

Fig 7. The use of geolocation technology.

At the next site, where the user enters selecting "Next >>" makes use of Geolocation technology. In this system, therefore, the Geolocation deliberately

performed with functions, for reasons of ease of use, convenience, and simplicity of the system (do not want to force the user to install an application) rather than applications such as those offered by Google maps API (Geolocation, Geocode, formerly the Gears API and several others). Thus opening the site created a map with a Pin at its center. The Pin is located in the center of the map and shows the nearest node from which the respective provider provides internet user.

This feature of the internet is possible only from computers (desktop or laptop). For mobile this function is meaningless because the traceability provided by the application Google Maps combined with GPS that integrates third-generation mobile phone.

Moreover but at the same site, as shown in Figure 8 runs a php code which displays the coordinates of the Placemark and below there is a form with various possible categories that the user can use any time. These categories include the Map locations of the points indicate the category and then selecting next >>, the user goes to the next page, while the variables are transferred.

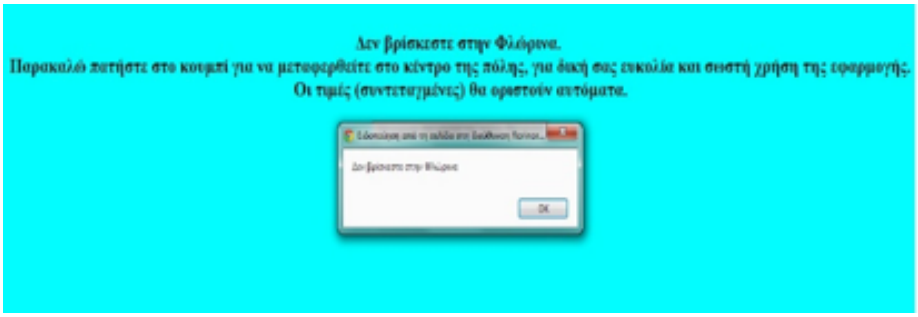

Fig 8. Control of user's location.

Before the user browses to the main page of the system with basic functions, a check is made whether the user is actually located in Florina.

5 Conclusions

The system implemented is innovative and completely different from the existing Web services that use location of the user. The existing system identifies the location of the user (when it is connected only to laptops or desktop computer, because the localization of the mobile devices is made by applying Google Map or Google Earth and the use of GPS mobile phone) and then urges him to choose the information he wants.

Applications like this are designed and made having as a goal to inform and advertise the city, various places, locations and shops, but also to serve tourists, visitors and anyone else who is going to stay in town for a period. It concerns portable devices, especially mobile phone, to have immediate results.

The system lets the user the freedom to choose the category with points of interest and then to load them in mobile phone or process them by computer (like KML

files). All information occupy the mobile phone user (the application Google Map or Google Earth) for future use.

This system can be used directly, in real conditions, but having a small range information. Then however the correct constant support, renewal and expansion could become very popular and serve many users.

The disadvantage is that it is available only for Florina. The advantages are many: many categories of information, the ability to display the perimeter points of interest to the user, the access from the mobile phone and the computer (portable and fixed), the direct transfer of information to the device as a KML file, ready for processing by an Earth browser (e.g. Google Maps, Google Earth and others).

The biggest advantage, however, is the possibility of adding a new location or from the mobile or the computer (laptop or desktop) to the system and the direct use of the system. Furthermore, the system to the home page, using the Timeline, presents chronologically different events taking place in the region of Florina, and their duration.

Other mobile applications such as the Foursquare, Gowalla, Veladia, function as social networks (socializing networks) and allow the user to communicate with others (and to become friends) and several other functions that do not focus the existing system of whose purpose is to provide information and raise awareness about the different parts - sites in Florina.

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E-Waste Management & Clean Technologies

Leon Thaqi[1]

[1]MSc in Management, City College (Sheffield University), Thessaloniki, Greece, e-mail: lethaqi@city.academic.gr

Abstract. Management of e-waste is becoming a challengeable issue in today's world. The increase of waste and the need for saving the environment are two global debates in the world. These managerial problems come as a result of technological advancements and globalization as global forces toward complexity. These global forces made e-waste management become a world's priority issue followed by cleaning technologies. Nowadays, industries are investing in e-waste management and cleaning technologies in order to save the planet, be healthier and reduce the pollution. However, it is very difficult to control the e-waste management because technological advancements will not stop and the electronic waste will become bigger problem for the world. Digitalization of the world brought benefits for people's life by facilitating the lifestyle; however, digitalization of the world increased the percentages of e-waste management all around the world.

Keywords: Management, e-waste, technology, globalization.

1 Introduction

World's population is increasing rapidly and there are emerging contemporary problems which are caused by humans. One of the most important problems that the world is facing nowadays is the electronic waste or the so-called e-waste. E-waste consists of valuable and toxic substances which have a great potential in harming human's health and environment. In addition to that, depending on the exposure level, health and physiological impacts of these substances are very high (Pavan & Dasgupta, 2010). There is a European Community which was developed for Waste Electrical and Electronic Equipment (WEEE) for the countries to follow the directives for reducing the e-waste overall. By looking at the most advanced technological countries it can be derived that U.S. and China are the most producers of electronic devices. However, only 12% of these electronic devices are recycled. The other countries just recycle a small part of their waste (Premalatha, 2014). Human health and environment should be protected especially in today's world where e-waste have become a problematic and complex for countries with a high density of population. Knowing the fact that waste is considered everything that surrounds us, brought up a global debate of reducing or recycling the waste. In order to protect the environment, people should come up with ideas such as recycling

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campaigns in order to fill the gap of environmental protection. Also, in solving the global electronic waste problem a numerous of attempts have been made to increase the efficiency in recycling e-waste management activities (Jinhui et al., 2015).

Having in mind that toxicity is very dangerous for human health, especially for organism that can cause damages, analysts, researchers and experts have started thinking of new technological methods of saving the planet (Zeng, 2015). Humans are meant to be the savers and the destroyers of this planet but it depends on the idea and the culture of a specific country whether they want to deal with problematic issues such as e-waste. Countries do produce waste everyday but the question is: Are they socially responsible or not? Many countries started paying a lot of attention to the e-waste management in the last decade because of the awareness of electronic waste. The awareness of electronic waste emerged because of its hazardous substances that it contains (Yeh, 2012). Secondary data and empirical observation have been analyzed to come up with any possible solution for Kosovo. In this case, there is a need for e-waste management because of the density of population. Since Kosovo is the newest country in the world, I believe that being part of these contemporary projects will help the country have better environment and better health in terms of population. Most of the less developed countries have these kinds of barriers in implementing these projects because of corruption, unemployment and economic development as the main tools for sustainable country. According to the research, Kosovo is reducing and preventing the increase of waste quantity (Baftiu, 2015).

2 E-Waste – A Growing Concern in Today's Environment

Electronic waste becomes a very important issue when the potential damages of them have been considerate. This concern emerged rapidly at every nook of the world because of the statistics saying that the worldwide sales of computers, in units, reached 270 millions in 2007. Furthermore, mobile phones do also play an important role regarding this issue as electronic devices. The electronic waste that has been created is very hard to be prevented because of technological advancements, globalization and increase of world population. These three characteristics are highly related to one another that could create an enormous amount of waste. However, the origin of e-waste has been raised from the updated hardware and software technologies that attracted the market and facilitated the lifestyle of humans. So, this lifestyle is mainly characterized by access to information, technological advancements and managerial issues which are combined in electronic devices such as computers or smart phones (Renckens, 2008). Countries have started to transport the waste to other countries just to recycle them and reuse them also. As an example, Canada's government wanted to implicate the policies and regulations for e-waste. Canada's government had two approaches toward e-waste which were toxic reduction in electronic devices and minimum release of toxic substances at the end of lifetime (Deathe, 2008).

Valuable and toxic substances have been seen in electronic waste. There are different substances that may release toxic substances such as phosphor, copper, lead, plastics etc. These substances are mostly present in electronic devices which cover 70% of US landfills with heavy metals. What makes this problem complex is that the replacement of computers have been applied almost every five years while the replacement of smart phones is maybe less than a year. This explains the complexity why it is so hard to manage the electronic waste while people still do store them (Pavan, 2010).

Table 1. The categories of products with details of a recycling company in Australia.

E-waste product category	Description
E_1 Computer	PC, notebook computer, CRT monitor, LCD monitor, PC keyboard, mouse, cables associated with PC system, modem, etc.
E_2 Communication equipment	Server, rack mount cabinet, hub, switch, router, modem/print server, assorted network gear, PABX controller unit, telephone handsets, uninterruptable power supply, etc.
E_3 Battery	Lead acid battery, lithium ion, lithium battery, NiCad battery (sealed/vented), NiMH battery, Alkaline battery, etc.
E_4 Mobile phone	Mobile phone handsets, batteries, chargers, accessories, etc.
E_5 Office electrical equipment	Desktop printer, enterprise printer, photocopier, fax machine, desktop scanner, desktop multifunction printer/scanner, etc.
E_6 Consumer electrical equipment	CRT television, plasma television, LCD television, VCR/DVD/set top box, Hi-Fi stereo, speakers, domestic vacuum cleaner, microwave oven, cordless phone, video camera, digital still camera, etc.

Note. Cathode Ray Tube (CRT), Liquid Crystal Display (LCD), Personal Computer (PC), Private Automatic Branch Exchange (PABX), Nickel Cadmium (NiCad), Nickel Metal Hydride (NiMH), Video Cassette Recorder (VCR), Digital Versatile Disc (DVD), High Fidelity (Hi-Fi).

With a very qualitative management department, this company can destroy, recycle and reuse the electronic waste with the most innovative techniques. The biggest clients of this company are the governments and the main producers of well-known global brands such as HP, Dell, IBM, Toshiba etc. This company provided this table by grouping the e-waste products in six categories shown above. What differences this recycling company is the sustainability within a company and the sustainability in terms of social, economic and environment aspects (Hsing, 2012). European Union has tried to be engaged to e-waste technologies and management in order to develop a plan of recycling the unwanted technological devices or the outdated ones. Based on the research, Europe produced 11.6 Mt of total e-waste in 2014. However, in 2012 only 3.2 Mt was collected by 28 member states. Findings show that western Balkan region did not implement an effective e-waste system like EU member states. Including Kosovo here, this means that Kosovo still does not have a national legislation dealing with e-waste (Baldé et al, 2014).

Knowing the fact that e-waste is increasing extremely fast and the difficulties to handle the e-waste management is pushing countries forward to develop a solution and create a market and offer solution for e-waste management (Neyland, 2012).

Even though waste management is very hard to be controlled, countries do collect their created waste. According to World Bank, countries with high incomes do collect the waste (around 96% collection of waste) in comparison with low income countries that collect the waste much less (around 40% collection of waste) (World Bank, 2012).

3 The Global Impact of E-Waste

E-waste has achieved a critical point globally in terms of the massive technological and electronic production. This critical point is growing very fast and the main priority of industrial management is to find a proper way of saving the environment and people's health. Having in mind that the population is still growing and the production will not stop; there is something that should be done in terms of e-waste. As mentioned above, the main producers of e-waste are U.S, Western Europe, Japan and China with a total of almost 50 million tons of it.

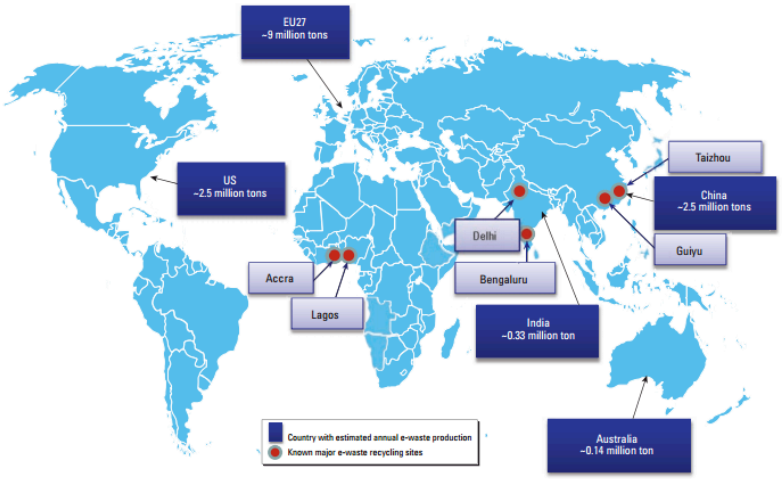

Fig. 1.

The figure above explains the importance of e-waste and how countries have thought of it by reducing their waste. The key success factor of helping the environment is to reduce as much as possible the e-waste substances by producers and recyclers. This picture shows that many countries have shown progress and commitment regarding this issue (Chen, 2011).

There are still opportunities for e-waste management in a large scale, especially with metals. Metals can be re-produced by recycling process. Most of the today's production that contains metal has been modified to low carbon technologies as a new way of production. This low carbon technology is a key metal resource which can be found in electric cars, light bulbs, wind turbines and many other green technologies. For example, a Belgium company Umicore that recycles more than

35,000 t/each year of e-waste, mostly mobile phones. This company believes that motel recycling companies gain a lot of profits, especially the last five years where people see a great potential of it (Burke, 2010).

In terms of environment and ecological way of thinking, there is still a global debate for almost a decade. Most researchers and experts believe that environmental problems are highly related to digital economy. The digitalization of economy has great impact on social, environmental and economical aspects of the whole world. Everyone out there gets touched by these changes or chronic problem. The technological advancements in terms of electronics have expanded so much by using them. These electronic devices made life much easier either the daily routines or office work (Ciocoiu, 2010). Environment and e-waste management differ a lot from each other based on the product waste and the substances that it releases. Environment with a full of e-waste may harm even the underground resources of a country. Natural resources such as gold and silver may be influences from the e-waste by finding them more quickly than using the traditional way of mining. Hence, world is thinking of creating a market for e-waste by reproducing them or recycling them in order to reduce the waste generation (Deathe, 2008). In the case of Kosovo, based on the research, Kosovo lacks of using any effective way of stopping the waste production but it is getting into the law enforcement regarding e-waste management. Many campaigns have been organized by increasing the awareness of environment. The table below shows the amount of waste produced by three European Countries and Kosovo's treatment of the waste.

Table 1: The amount of waste in three EU countries and Republic of Kosovo

	Austria	**Denmark**	**Slovenia**	**Croatia**	**Kosovo**
Number of inhabitants (m)	8.1	5.4	2	4.45	2.3
Total amount of waste (million tonnes/ day)	48.6	13.0	8.4	12.6	2.504
Amount of municipal waste (million tonnes) per year	3.1	3.1	0.8	1.2	~ 0,4
Annual amount of municipal waste per capita (kg)	383	574	400	270	192

Table 2: Treatment and disposal of waste in three EU countries and Kosovo

	Austria	Denmark	Slovenia	Croatia	Kosovo
Waste collected for recycling	34.3%	14%	10%	10%	9%
Waste collected for biological treatment	21.7%	-	12%	1%	1%
Waste collected for incineration	14.7%	81%	-	-	-
Waste collected for land filling	28.5%	5%	73%	89%	90%

Source: the data in Tables 1 and 2 for Kosovo are calculated and based on a report on the state of waste in Kosovo in 2008.

4 Clean Technology Revolution

The use of solar energy and renewable energy has been a debate on a global scale recently. The use of renewable energy have emerged the market that seek for profit. This new way of promotion green environment with renewable energy is having a great success in terms of investments on it. Being monopolistic in today's world is having an advantage of producing goods or services by using clean technology which saves the environment and reduces the pollution. These types of advantages are highly required in today's industries. The advantages of this technology are because of the low cost and the reduction of pollution which will promote a new way of living and new way of manufacturing goods. New cleaning technologies use renewable energies that will create the above mentioned advantages of a specific company (Youssef, 2015). An example supporting this fact is the Colorado state which has involved 700 companies in clean technology market by employing more than 20,000 local employees. This positive initiative of Colorado has been as a role model for other states in the U.S to develop climate and energy policy. The biggest investor in the world in cleaning technologies is China which exceeds the investments of Colorado with a margin of 50 to 1 (Spaanstra, 2010).

Revolution of clean technologies has some barriers regarding the implementation of it. This implementation is highly related to property rights, import/export taxation which may reduce the investments because of the high risk. There should be a free market in terms of promotion these kinds of technologies even in the poorer countries that do not have access to them. Globalization has a great impact on cleaning technologies in terms of development and deployment of renewable energy (Vennemo, 2015).

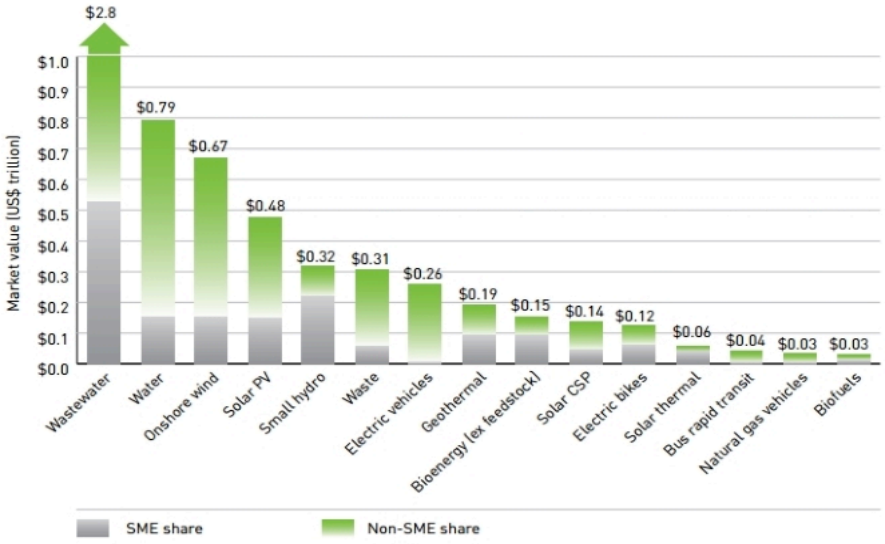

Fig. 2.

The graph above explains how U.S's market value is distributed between SME's and non-SME's shares in terms of cleaning technology. It is obvious that these countries of U.S have thought of clean technology in terms of economical and environmental way.

In the case of Kosovo, Ministry of Environment and Spatial Planning have developed a plan on waste management from 2012 to 2016. This plan explains the main objectives of such as strengthening waste management, areas which needs investments in terms of waste and infrastructure and raising the awareness of waste. This article suggest that by implementing this plan Kosovo will have an opportunity to attract investments on cleaning technologies as a critical point for the future (PRKWM, 2012).

5 Conclusion and Recommendations

In today's world enormous amount of e-waste is generated from developed countries which have caused serious pollution all around the world. Most of the producers, as mentioned above are U.S and China that have strong industries in terms of technology and produce great amount of electronic waste (Jujun et al., 2014). According to research, globalization process and technological advancement have conquered the world, regulations, policies and recycling technologies have been implemented by some producers, in order to protect and save the environment. Risk assessment for humans has increased due to e-waste (Jianjie, et al., 2013). However, by implementing laws and regulatory programs, positive effects have been seen in controlling and releasing heavy metals to the environment. The main critical point of technology advancement and increase of electronic waste is that features and capabilities of technological devices are rapidly changing. As a result of these changes, new ways of e-waste management have to be considered (Kang & Schoenung, 2005). Based on the empirical observation, recommendations will be addressed to government of Kosovo in order to collect and reduce the e-waste. Some activities that government of Kosovo should perform are implementing standards for treating and processing e-waste, implement an action plan for collecting e-waste from households, encourage improvement of e-waste through inspecting by any national agency.

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A Review of ABC Methodology for Agricultural Sector

Georgia Koutouzidou[1], Athanasios Vazakidis[2], Alexandros Theodoridis[3], Christos Batzios[4]

[1]Department of Applied Informatics, University of Macedonia, Greece, e-mail: koutouzidougeorgia@yahoo.com
[2]Department of Applied Informatics, University of Macedonia, Greece, e-mail: vasak@uom.gr
[3]School of Veterinary Medicine, Aristotle University of Thessaloniki, Greece, e-mail: alextheod@vet.auth.gr
[4]School of Veterinary Medicine, Aristotle University of Thessaloniki, Greece, e-mail: batzios@vet.auth.gr

Abstract. This study examines recent advances in cost accounting methods with special reference to the application of Activity Based Costing methodology in primary sector. Large scale agricultural enterprises that depend heavily on capital investments require rational allocation of the available resources and efficient utilization of the existing production technology. The accurate and reliable computation of cost per unit of product is crucial for the evaluation of the economic performance of the enterprises and the investigation of the optimal allocation of the production factors in different activities. The concept of Activity Based Costing methodology, which is of great importance in the system of cost accounting, allows the allocation of indirect costs to specific activities and individual products, overcoming the drawbacks of the traditional method of cost accounting. A synopsis of the Activity Based Costing method is described, followed by a review of recent cost accounting applications to agricultural systems.

Keywords: Activity Based Costing, Cost accounting, Agriculture

1 Introduction

The primary sector in Greece remains one of the most important economic pillars, which plays a vital role from both a social and environmental perspective. Agriculture in Greece was based mainly on small-sized, family-owned dispersed productions units, however since the 2000's a rapid increase of large size, market-oriented farms was emerged along with the development of food-processing companies. These production units, which are of purely entrepreneurial nature, depend heavily on capital endowments and high human capital. Despite its diminishing contribution in GDP (about 5%) and employment (479.612 persons are employed in agriculture (ELSTAT, 2014), that is 12.5% of the total labor force), livestock and crop farming and agricultural processing industry constitute important production sectors for the Greek economy, that support manufacturing and boost rural economy. Agriculture supports rural family incomes offers employment to a

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large number of people and reverses depopulation and marginalization of mountainous and less-favored areas, contributing this way to the recovery of national economy and the stimulation of economic growth.

The economic crisis in Greece has undoubtedly influenced the productivity and economic performance of the primary sector, challenging the competitiveness of the agricultural farms and food-processing units. The high prices of inputs - mainly of fuel - affect the profitability of agricultural production units adversely, low producer prices cannot counterbalance income losses from the increased production cost and the uncertain overall economic environment which is the main cause of financial stress impedes the effective marketing of processed and non-processed products. The capital intensive agricultural enterprises with a significant share of indirect costs require efficient utilization of the existing production technology and rational allocation of the available resources, which implies the important role of management accounting in the evaluation of the operational performance of such modern agricultural enterprises.

In this context, the accurate computation of cost per input, activity and product can be a useful tool in order to design a medium - long term strategic plan regarding resource allocation and pricing, vital elements for the improvement of the producer's profitability. The purpose of this study is to examine recent advances in cost accounting with special reference to the Activity Based Costing methodology in primary sector.

2 The ABC methodology

The concept of ABC was developed in the manufacturing sector of the United States during the 1970s and 1980s, however the method was first clearly defined in 1987 by Kaplan and Bruns. The Consortium of Advanced Management, International (CAM-I), an international consulting group, provided a formative role for studying and formalizing the principles that became more formally known as Activity-Based Costing (Cardos and Pete, 2011). The concept of ABC was introduced in order to overcome the shortcomings of the traditional method of cost accounting through the proper allocation of the fixed costs to products (Cooper and Kaplan, 1988). The traditional cost methods were used efficiently at a time when the dominant factors of production were labor and variable capital and hence, their corresponding direct costs were easy to allocate (Carli and Canavari, 2013). The inefficacy of the standard method occurs when the share of the indirect cost of the fixed capital (mainly maintenance, insurance and machine preparation) was significant in total production cost. The traditional cost accounting methods in modern business environment where the level of fixed costs is high usually leads to underestimation and overestimation of the cost per unit in small and large production untits, respectively.

In recent years, many production units have improved their cost management by utilizing the ABC system, a tool for providing accurate and relevant cost information (Lee and Kao, 2001). Activity-based costing (ABC) is a costing methodology that identifies activities in an organization and assigns the cost of each activity with resources to all products and services according to the actual consumption by each.

This model assigns more indirect costs into direct costs compared to conventional costing. According to Dierks and Cokins (2000) ABC "measures costs and performances of activities, resources and cost objects[1], assigns resources to activities and activities to cost objects based on their use and recognizes causal relationships of cost drivers to activities". There are four steps involved in Activity-Based Costing (Lanen et al., 2008). The first step includes the identification of the key activities, by classifying them into value added and non value added activities. After the selection of the activities the resources consumed and the associated costs are allocated to individual activities. In the second step, the cost drivers (measure of output of an activity) are associated with each activity, while in the third step a cost rate per cost driver is computed. In the final step, costs are assigned to products (Fisher, 2012).

The ABC methodology is still developing and comprehensive reviews and extensions of the model can be found in Hansen and Mowen (2000). This methodology has been extended to the field of agriculture production activities, although limited studies have been so far focused on the estimation of the cost elements of entire products, activities and services through ABC.

3 Review of ABC studies in agriculture and their implications

This section provides a review of empirical applications of Activity Based Costing to various agriculture production systems. In general, the implementation of ABC methodology is limited due to the high quantity of data required for its application. Especially in the farming and food processing sector the relevant studies on ABC applications are very few and include fish markets and fish processing, winemaking, ornamental plant cultivation, sawmilling, crop farming and dairy production.

Lee and Kao in 2001 analyzed the operational costs of the Pu-Shin wholesale fish market, which has the highest automation level in Taiwan, using a simulation technique as complement to activity-based costing model. The results of the simulation approach are used to obtain more accurate allocated resource costs and to avoid arbitrary allocation. The results of the ABC model indicate that the total processing cost is 2.36 NT$ per kilogram of fish, 0.17 NT$ higher than the cost calculated by using the traditional accounting methods. This can be attributed to the fact that Pu-Shin wholesale fish market does not calculate machinery depreciation during cost calculation. The authors claim that the ABC model used with system simulation can be applied to other agricultural systems.

ABC method has been also applied in Finish fish processing sector by Setälä and Gunasekaran (1996). The production process in fish industry in the country is highly automated and diversified. However the processors do not easily adopt tools in evaluating their economic performance. They believe that the accurate tracing of indirect costs and their efficient management is not a necessity for the success of the processing unit. Setälä and Gunasekaran applied ABC to fish filleting operations, which were split into ten micro-activities (cutting operations, washing, quality

[1] Cost object is any item as products, departments, projects, activities, etc, for which costs are measured and assigned (Lee and Kao, 2001)

inspection, etc.) and cost drivers were calculated in proportion of fish taken to production. The time consumed by filleting activities and flesh loss ratio were the most important performance measures incorporated in the model. These new measurements required for the application of ABC technique increased the cost of the production system; however the benefits from more accurate and reliable cost information were greater than the cost of these new measurements. Concluding their case study, the authors claim that ABC would be an appropriate system in fish processing.

González-Gómez and Morini (2006) proposed the application of an adapted ABC system for the cost estimation of winemaking in Spain, a sector that faced many changes in production and in consumer demand. The ABC model was applied based on data which were collected from local equipment and grape providers and from surveys of winery managers and operators. In this study the production process is divided into activities performed in the harvesting, in the winemaking and in the complementary winemaking process. The costs for each activity are divided into direct and support costs. The findings of the study indicate that the ABC model could provide valuable cost information to assist winery managers in improving their business competitiveness.

The same authors applied ABC model for cost calculation and management in a multiproduct agricultural framework, using ornamental plant cultivation as a case in point (González-Gómez and Morini, 2009). In their approach internal costs are used instead of accounting data. The authors estimated the direct and indirect costs through economic and financial assessment of the activities, with the total cost being the sum of these components. After calculating the total cost and gross margin of each plant in the sample, an overall cost and performance analysis is conducted for a "standard crop" (weighted means of each plant). According to the authors the study achieves through the ABC model "a more objective assignation criterion for indirect costs as well as for the differentiation between several products and technologies in the cost calculation process".

The study of Pockeviciute (2008) develops a budgeting model for dairy farms in Lithuania using the ABC method. The actual production cost budget per 1 kg of milk was estimated to be 0.572 TL/Kg, while the share of the overhead costs was 47% of the total production cost. The authors conclude that the calculations of the production cost of the milk yield (the cost driver) provided a detailed overview of the expenses and their contribution in total production cost of milk.

4 Conclusions

The diversification and intensification of international competition, the adoption of new and innovative technologies on machinery and equipment and the uncertain economic environment has made proper and accurate production cost information essential to competitive success. The complexity of contemporary production units that produce a wide range of products and have a high share of overhead costs to total costs renders the reliable estimation of the cost per unit problematic. The ABC method provides the flexibility required for the accurate calculation of cost per unit

in modern businesses by tracing indirect costs first from resources to activities and then from activities to specific products. In comparison with traditional, conventional cost accounting systems, ABC is more adjustable, faster and more accurate, enabling a detailed cost analysis. The importance of ABC in agricultural systems is justified in large modern production units of non processed and processed products that have a significant share of indirect costs. ABC in crop and livestock production could be an important tool for planning and accounting analysis; however its applications in primary sector are still very limited.

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Wood Trade in Greece: The Impact Of Economic Crisis And The Use Of New Technologies

Ioakeim Tzoulis[1], Zacharoula Andreopoulou[2], Marios Trigkas[3], George Tsekouropoulos[4], Elias Voulgaridis[5]

[1]Aristotle University of Thessaloniki, Department of Forestry and Natural Environment Thessaloniki, 54124, PO Box 247, e-mail: itzoulis@for.auth.gr
[2]Aristotle University of Thessaloniki, Department of Forestry and Natural Environment Thessaloniki, 54124, PO Box 247, e-mail: randreop@for.auth.gr
[3]Aristotle University of Thessaloniki, Department of Forestry and Natural Environment Thessaloniki, 54124, PO Box 247, e-mail: mtrigkas@for.auth.gr
[4]Ph.D. in Agri-business Marketing, Alexander Technological Educational Institution of Thessaloniki, e-mail: geotsek@mycosmos.gr
[4]Aristotle University of Thessaloniki, Department of Forestry and Natural Environment Thessaloniki, 54124, PO Box 247, e-mail: evoulga@for.auth.gr

Abstract. In wood trade, the supplier is the forest and the product is round wood. The quality, the quantity and value of wood depend heavily on the practices that are applied in the early stages of the supply chain. Current methods of the the productive capacity of forests, the annual consumption of wood and wood products, both from natural and technical forests and also from imports are presented. The aim of the paper is to aggregate data on timber trade in Greece and also to study how the economic crisis has affected the forest, its products and how it has affected trade (imports and exports). We will present the characteristics and elements for timber products gathered and present the results in tables and diagrams. Finally, we will present the use and utilization of new information technologies, such as databases, digital timber traceability systems, sustainable timber and wood products, in collaboration with the traditional methods used in timber trade.

Keywords: wood trade; supply chain; technologies; economic crisis; wood products

1 Introduction

In the field forests exploitation, plenty has been achieved to this point, and this is due to the development of the science of Forestry and consequently, to the scientific management of forests. The basic principle of forest management is the sustainability of profit from the forests. This principle ensures on the one hand the continuous supply of forest products and services and on the other, the preservation, maintenance and improvement of forests. While in forest ecosystem management and governance, the essence of governance is its focus on governing mechanisms which do not rest in recourse to the authority and sanctions of government.

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Governance has been reformed in order to achieve transparency, efficiency, and accountability and to end with sustainable economic development. The Internet provides a new prospective with the provision of quality services within the social, financial and cultural regional forest development (Andreopoulou et.al. 2012).The rapid development and global spread of modern information and communication technology (ICT) allows the developing world to leapfrog the infrastructure constrains to access and utilize information vital to forest research and development. Stronger emphasis is given to the analysis of the entire forest-agronomic production systems to support the need to design agro-eco-systems that increasingly have to fulfil multiple objectives. Such interdisciplinary analyses need input from a wide variety of disciplines, which, in turn, are used to better define and understand the complete agronomic production system. Provision in agricultural governance can be implemented through ICT focusing on informing, directing, managing and monitoring agricultural and environmental activities toward the achievement of sustainable agriculture (Andreopoulou, et al. 2011).

Environmental and agricultural governance can be enhanced through IT applications and techniques, ICT and e-services adoption, GIS employ, supply chain management use and database exploitation. When properly stored, forest and wood data can be easily retrieved and they can be processed in many ways from end users. ICT's give the integrated organization the opportunity to access to a large amount of forest and wood information with a set of online services (e-services). The ability to access huge amounts of data, effortlessly and quickly, is the incentive for better communication, scientific growth and technology development, thus, the adoption of ICT in public administrations as it is combined with organizational and structural change aiming to improve public services and sustainable development (Tzoulis, et al. 2013). Additionally, a web-based environmental database is a collection of organized environmental data that serves multiple applications. The organization of data in a database online, results in program data independence, data redundancy, enhanced data consistency, improved data sharing, increased productivity, better data accessibility and responsiveness and reduced program maintenance, as in simple database systems.

Wood produces in appropriate and specific processes, thousands of products, many of which are basic necessities (eg paper, wood furniture, matches, etc.) (Voulgaridis 1996). Forests occupy 1/3 of the land surface (FAO, 2000) and play an important role at several levels. From an economic perspective, the forestry sector is an important source of income, as timber is used in a variety of construction, household and industrial operations. Today, forests contribute 14% of the global energy supply and have the ability to reach up to 50% in energy requirements worldwide during this century (Hall, 2002). About 55% of the amount of wood used worldwide (CRES, 2010) (which reaches 4 billion m3), is used as a wood or charcoal for daily energy requirements that concerns heating and cooking in developing countries. In our country, until the 1950s, 15% of energy was coming from the forest (Kompelitou & Koskina, 2004), in the form of firewood and charcoal. In recent years, new and innovative digital solutions and technologies play an important role within strategic planning and decision support in wood entreneurship sector. The study and analysis of the current situation of trade in wood products in the European Union is an important tool in decision-making by the industries of wood. The

information on the supply and demand of various wood products and the forecast for the future is sufficient by itself to reduce the risk of business (Tzoulis, et al. 2014a). The ability to perform and track the whole follow-up of products in industries has been doable with the implementation of information systems, of automatic identification, which are capable to create a link between the product, the database of the product and of process. Traceability information systems consist of processes to maintain records that expose the trace of a particular input from suppliers to customers. Wood traceability information systems make sure that wood derives from sustainable sources and supply a successful technique to fight illegal logging. These Information systems cover data on the source and movement of wood throughout harvesting area until its final destination. It is important to achieve detailed tracking of the log production and movement of timber and wood products aiming to guarantee the legality of the product (Tzoulis, et al. 2014).

The value system is completed by the principles that forestry follows, among others, the principle of multiple use, the principle of sustainability, the principle of cost effectiveness and the principle of comprehensive and integrated approach management. These principles governing forest management and identify the key management rules and conduct on the implementation of any effort management objectives. The first principle, the effort to maintain and promote the multiple functions of forests derives from the fact that forests play a multiple role in the field of the environment, thanks to the multiple functions that characterizes it, and their ability to contribute decisively to maintaining nature and overall ecological balance. The multiple use one the hand preserves the multidimensional nature and biodiversity of the forest and on the other hand contributes more effectively / efficiently to the social welfare and development from single use. Sustainability, as a concept, is focusing at first on the ability of the forest to produce goods and service in accordance with the objectives of forestry. It constituted a basic principle for forest management from the first steps of Greek forestry, which in forced it, on the one hand forest conservation reasons and secondly the need for continuous coverage of annual requirements in forest products. The economic principle points the need that throughout the management of forests to constantly strive to shape a favorable relationship between the available instruments (expenses) and income (interest). The comprehensive and integrated approach stems from the nature of forest ecosystems, as a single and indivisible sets (ecosystems), as well as the need to preserve the unity and continuity of these in the conduct of forestry activities. Basic threat of degradation and destruction are mainly split and fragmented and unplanned intervention in forest ecosystems (Gkatzogiannis, S.2005). The purpose of this study is to record the effect of the economic crisis on timber trade in Greece and the use of new technologies.

2 Methodology

In this paper, will be presented aggregated wood trade data in Greece and further, will be discussed how the economic crisis has affected the forest, its products and how it has affected trade in imports and exports. Moreover, the use of new

technologies will be discussed. The study was conducted in 2015. Two main products categories of wood produced in the forest, construction timber and fragmentation wood, are presented along with the annual use of wood and wood products in Greece. We will also study the wood amount of production from public and non-public forests. Data of timber will be recorded and the results will be gathered in Tables. We will also examine the impact of economic crisis in wood trade sector in Greece, in Greek forests and the trade of firewood. The three main forest production stages are studied: the Primary (organic) Forest Production, The Secondary (mechanical) Forest Production and Tertiary (industries) Forest Production. Finally we present the use and utilization of new information technologies in wood trade certification, where various traceability systems are collected and studied in order to add flexibility and immediate feedback on the marketing of timber space, always in collaboration with the traditional methods used in timber trade.

The data of the Greek wood sector and therefore imports and exports in trade, were retrieved from the Centre for Renewable Energy Sources, the Reports of Greek Forest Services, Greek Ministry of Agriculture and FAO. Data were also collected by relative research books and studies (Tsoumis, 1983, Voulgaridis 1996, 1996a, Reuber και Fischer, 2011, Chaslidis, 2012, Tzoulis and Andreopoulou, 2013, Tzoulis et.al. 2013, Tzoulis et.al, 2014). Some of the keywords that were used in internet research are: wood trade, technologies, economic crisis, supply chain, ICT's and wood products.

3 Results

The annual production of wood from the forests globally to meet human needs is approaching 3.5-4 billion cubic meters, while forecasts show that wood consumption is increasing (Tsoumis 1983). Our country, Greece, is strong deficit in wood and wood products and imports significant quantities of round and sawn timber, wood pulp, etc. that are representing a total of 2,000,000 cubic meters of round wood equivalent per year. The forest cover rate (25.4%) of industrial forests is considered relatively small for a mountainous country. In the composition of our forests broadleaved species dominates having a percentage of 57% against the 43% of coniferous species. An additional percentage of 23.9% of the country's area is covered by non-industrial (non-productive wood) forests composed mainly of evergreen broadleaved (Ministry of Agriculture, 1992)

Two main categories of wood formed in the forest: a. Industrial timber includes: (1) The construction timber, which is called round wood and technical wood and (2) fragmentation wood (or industrial), which is used after the conversion into particles by crushing for particleboards, fiber and paper. b. Firewood that is pieces, round or slit, and are predestinated for household needs. From the total country's public forests 2.707 million cubic meters timber are produced annually (786,000 cubic meters of industrial timber and 1.921 million cubic meters firewood, ratio 29: 71). Those quantities estimated to be added another 400,000 cubic meters Industrial timber and

650,000 cubic meters firewood from private forests and plantations, community, monasteries and other non-public forests (Voulgaridis 1996a).

Overall, the annual consumption of wood and wood products in Greece is approximately 3,100,000 cubic meters equivalent round wood (not including amounts of produced firewood). The part thus of the domestic production from industrial timber is only 30-35% of the country's needs (Voulgaridis 1996). Other species that produce small quantities of wood are: cypress, birch, plane tree, maple, walnut, helm oak and other broad-leaved evergreen, etc. Natural forests of our country although they are growing satisfactorily in mountainous and hilly areas, remain in poor condition in terms of quality of the growing stock and the ability to produce technical wood. This is due to small and fragmented throughout the mountainous Greece production volumes, the unstable and often poor quality of the product, the constantly growing production costs, and the lack of industries producing finished products and powerful competition that exists on imported products. The result is either the distribution of the technical timber be done by loggers directly to small scale local crafts, and utilized in low value added products, whether it remains unsold and is offered at prices below production costs or compromising on firewood.

The evolution of the technical production of wood from the Greek forests is obvious that during the last thirty years has a drop in its production of 60%. Moreover, while imports in the early 80s covered only marginally the production, in the early 90s accounted for more than twice, and arrived in the early 00s to more than five times. Similar was the trend in terms of production of firewood (Forest Services Report 2009). Forests provide many benefits to society and the economy and play an important role in preserving biodiversity and mitigating the climate change, they also covering 177 million hectares (42% of the land area) of the 27 EU Member States. According to FAO, public sector holds 41% while private and other are holding 59%. In Greece covers about 20% of its surface. The Greek forests and woodlands are characterized by high ecological value and biodiversity. Of the total forest, 22% are conifers (pine, spruce, etc.), 30% broad-leaved deciduous forests-primarily oak and the remaining 48% are non-industrial forests. The wood-stock that forests are giving is: coniferous: 54 m3 / ha, deciduous broadleaf: 27,8 m3 / ha, total forest ecosystem: 21,2 m3 / ha. From the total timber produced quantity that serves, as firewood is 70 % of the timber, while in Europe the same category is 7-10%. The remaining 30% of the wood harvested, is used as construction wood and industrial wood. Their exploitation is made by their owners in accordance with the management studies, with their care, and approved by the local forest services. Regarding forest products produced therein, other than wood, they include Christmas trees, ornamental plants and herbs. Non-public forests constitute 36% of the Greek forests. In terms of composition and capacity these forests are not lacking at all against those from public, on the contrary too many outweigh (FAO, Global Forest Resources Assessment 2015).

But there are factors that greatly influence the rational exploitation of non-public forests and such are: small size in terms of surface, the capital investment reluctance infrastructure and culture and development of these forests. The capital investment reluctance is mainly because there is reduced and long-term performance of forests and the social character of forest ownership and the emergence of many co-owners

so there are discrepancies regarding the correct management. Following there are details on the development of imports and exports of wood products and paper in Greece during the decade 2004-2013, where in some categories the decline observed in recent years is vertical (Data source: FAO, Global Forest Resources Assessment 2015).

Table 1. Imports of wood and paper products (2004-2013), (FAO, 2015)

UNITS x 1000		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Round wood	Cubic m	651	328	285	490	490	365	410	380	483	379
Industrial roundwood	Cubic m	280	282	216	170	170	165	140	154	93	93
Industrial coniferous	Cubic m	137	117	128	86	86	113	100	87	55	55
Industrial non-coniferous	Cubic m	143	165	88	84	84	52	40	68	38	38
Wood fuel	Cubic m	371	46	68	320	320	200	270	226	390	286
Wood chips & particles	Cubic m	193	358	429	24	429	3	26	49	8	14
Wood residues	Cubic m	1	3	6	9	9	6	11	27	97	55
Wood charcoal	Metric t	51	54	63	62	62	66	56	59	61	63
Sawnwood	Cubic m	918	874	898	928	670	446	370	289	227	223
Sawnwood coniferous	Cubic m	725	705	796	820	538	365	315	251	196	188
Sawnwood non-coniferous	Cubic m	193	170	102	109	132	81	55	38	31	35
Wood-based panels	Cubic m	482	427	506	417	413	328	274	235	146	195
Veneer sheets	Cubic m	23	27	24	29	29	39	31	24	11	11
Plywood	Cubic m	58	68	82	65	61	62	55	41	33	51
Particle board	Cubic m	133	134	180	142	142	94	92	79	74	103
Fibreboard	Cubic m	268	198	220	182	182	133	97	90	29	29
Wood pulp (chemical)	Metric t	113	102	76	80	80	124	162	128	130	152
Recovered paper	Metric t	6	10	8	4	4	11	6	9	19	12
Paper and paperboard	Metric t	597	710	1044	701	701	732	720	572	486	537

3.1 The impact of economic crisis on Greek forests, and trade of firewood

The economic crisis that our country faces has, or is expected to have, the following impact in wood trade on our country: 1) The total collapse of the presently weak demand for technical timber. 2) Increase in the demand for trade firewood, mainly oak and other hardwoods as well as beech. 3) Significant pressure from local mountainous populations to satisfy most of their heating needs from forests, which is obvious by the return on woodstoves and fireplaces that have been increased in mountainous areas 4) intensifying illegal-logging in mountainous areas, even in urban forests. 5) there is an increasing tendency in the number of seasonal dealing with logging and as well the working period in days. The final result is the increase

of pressure on the "productive" public forestry's to meet those needs, which ultimately supply firewood. 6) species that so far were considered unfit because of wood characteristics are now in demand for firewood because of the growing pressure for legal and illegal firewood 7) there is a huge pressure to meet production needs in biomass (crushing timber) in order to produce pellets, or by using logging residues either by direct mechanical collection of forest occupied by low shrubby vegetation. 8) seasonal increase in the price of firewood of beech and oak, which is expected to intensify in the future. 9) the distance from the place of wood production up to their final consumption areas causes explosive growth of prices. 10) the imports of firewood mainly from Bulgaria are continuously growing in quick rates,. 11) there is a significant increase in the number of firewood outlets in all areas in Greece is reported (Chaslidis, 2012).

Table 2. Exports of wood and paper products (2004-2013), (FAO, 2015)

UNITS x 1000		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Round wood	Cubic m	16	16	27	36	36	7	6	11	27	26
Industrial roundwood	Cubic m	1	0	21	30	30	5	5	8	21	22
Industrial coniferous	Cubic m	0	0	20	23	23	4	4	6	17	8
Industrial non-coniferous	Cubic m	1	0	1	7	7	1	1	1	4	14
Wood fuel	Cubic m	15	16	7	5	5	2	1	3	6	4
Wood chips & particles	Cubic m	0	0	0	0	0	0	0	0	0	0
Wood residues	Cubic m	0	0	7	0	0	17	12	12	4	13
Wood charcoal	Metric t	0	0	0	0	0	0	0	0	1	2
Sawnwood	Cubic m	18	13	9	14	11	17	19	25	26	19
Sawnwood coniferous	Cubic m	2	5	4	5	2	4	11	14	16	8
Sawnwood non-coniferous	Cubic m	16	8	5	9	8	13	8	10	11	11
Wood-based panels	Cubic m	201	200	81	82	80	150	155	232	257	178
Veneer sheets	Cubic m	1	1	1	2	2	2	1	1	1	1
Plywood	Cubic m	10	11	13	13	11	12	12	38	22	26
Particle board	Cubic m	167	155	30	34	34	81	77	96	127	74
Fibreboard	Cubic m	23	32	37	33	33	55	65	97	108	77
Wood pulp (chemical)	Metric t	7	5	1	1	1	1	2	0	0	2
Recovered paper	Metric t	104	141	154	195	195	364	315	238	321	269
Paper and paperboard	Metric t	73	72	68	119	119	82	89	92	86	87

3.2 Primary and secondary forest products

In forestry three main forest production stages exist: the Primary (organic) Forest Production: concerning the establishment, construction, farming, improvement and protection of forest stands, mostly studied and regulated by the Forestry measures sectors, the Forest Efficient, the Forest Management and Forest Protection. The Secondary (mechanical) Forest Production: concerning the opening-road construction, exploitation, harvesting, transportation and production of forest products. Tertiary (industries) Forest Production: is about the full refining and use all kinds of finished products (mainly wood, resins and biomass) by humans. Wood is

the raw material of various primary industrial processing products (sawn timber, plywood, etc.), which are materials for production of other secondary processing products (eg furniture, paper). Both the primary and secondary products can be produced by mechanical or chemical treatment (Voulgaridis, 1996a). For the main forest products we distinguish three phases or development stages, which are: Primary use: it begins immediately after the pre-labelling to the logging trees and ends with the production of raw feedstock products in the cutting area, the forest road or in the yard of the factory, the Forest Harvesting. Secondary use: it contains the use of raw forest products, such as heating with firewood and the production of semi-finished products, eg sawn timber, sleepers, piles, veneer etc. Tertiary use: includes full refining and use of forest products in perfected form in their final use, such as parquet, wood paneling, furniture, paper, packaging, wood etc.

3.3 The aspect of technologies in wood trade certification

The adoption of new technological developments and innovative management practices will offer flexibility and immediate feedback on the marketing of timber space (Tzoulis and Andreopoulou, 2013, Tzoulis et.al. 2013, Tzoulis et.al, 2014). Information and Communication Technologies (ICT) and innovative tools and services offer huge opportunities for everyone to advance and take advantage and new opportunities for economic development, better service, social and cultural developments (Tzoulis and Andreopoulou, 2013). Advances in information technology have been identified as drivers of entrepreneurship in the field of commercial timber (Reuber και Fischer, 2011). The internationally traded wood should come from sustainable-managed forests (FSC & PEFC). Two certification systems of sustainable forest management have been developed: a) FSC: Forest Stewardship Council and b) PEFC: Program for the Endorsement of Forest Certification schemes (ACE UK, 2012). Certification schemes have emerged in recent years to become a significant and innovative venue for standard setting and governance in the environmental realm. Using the FSC label requires chain-of-custody certification, which involves tracking the origin of forest products all through the supply chain and guaranteeing that products meet specific content requirements. Initially, only products with 100% FSC content had access to the label. The rules have since been revised, gradually reducing the percent thresholds, introducing new restrictions delineating acceptable non-FSC content, and developing an FSC label for 100% post-consumer recycled paper. In regard to reducing pressure for deforestation, researchers have also been skeptical about certification's potential impacts. Certification provides an inadequate counterbalance to larger economic incentives for land-use conversion. In 1998 and 1999, European forest owners' associations joined together to create the Pan-European Forest Certification (PEFC) scheme to facilitate the mutual recognition of national schemes and to provide them a common eco-label. The PEFC Council, composed of national governing bodies primarily representing forest owner associations and the broader forestry community, approves national schemes if they are developed in conformance with the criteria, indicators, and rules of the umbrella scheme. In 2003, PEFC restructured itself and went global, changing its official name to the Program for the Endorsement of Forest

Certification schemes while retaining the PEFC acronym. The certification model now exists in numerous sectors, covering an ever-expanding suite of production processes (Auld et al, 2008). The wood trade presents forest change, as it relates forest stock change to net trade of wood products by localizing the origin of wood consumed in a given nation (Kastner et al, 2011). Wood for trade should not come a) from illegal cuttings, b) areas of natural value, c) gene-modified trees, d) areas with social conflicts, e) natural forests transformed to other use (Korsnäs, 2012, Tzoulis et.al, 2014). This situation was the first indication of the necessity for developing and implementing systems of products follow-up (Stevens, J. et all 1998) and to increase the efficiency of the process and its technologies, (Töyrylä, 1999) highlights that it is possible to improve the logistics chain, the management, the supply and the optimization of raw material. Much remains to be determined regarding the application of international trade law to multicriteria environmental and social labels.

The objective of traceability in timber is to prevent the circulation of illegal timber, and explore ways in which it can eliminate the export and import of illegally harvested timber. Businesses have a growing interest in wood as overall current trends in modern society, the timber and timber products, is the raw material for various industrial primary processing products such as poles, sawn wood, veneer, plywood, particleboard, fiberboard, wood pulp, etc, which are the materials for the production of other products, such as furniture and secondary processing paper (Tzoulis et.al., 2013). Modern innovative wood traceability systems certify the supplier and the buyer that wood comes from sustainable sources and is a successful way to fight illegal logging. Information systems include data on the origin and movement of wood throughout the collection area to its final destination, ie throughout the supply chain of wood. The most common traceability systems in timber trade is one of the traditional methods: stamping / punching, the color marking, barcodes (barcodes), the engraving dimensional code QR (quick response code), Micro Wave Sensor (Experimental), microchip RFID, innovative digital DNA of the cluster, etc. (Tzoulis and Andreopoulou, 2013, Tzoulis et.al., 2014) and finally the traditional labeling with a metal plate that is used now in Greece. Various innovative methods, such as satellite systems and remote sensing systems, have been proposed in international level and other are still under research (Brack et.al. 2002). The web-database technologies are also utilized in the marketing of wood, for example in a DB for European and tropical woods, which lists the species of wood, the physical and chemical properties and their characteristics and their potential uses (Tzoulis et.al. , 2014a). An online database is an effective tool for management and management in general, since it is a data set that has some logical structure and grouping. The database structure provides data independence, have more consistent data, thereby improving the exchange of data, increases productivity, improves the accessibility of data and reduces the maintenance and management of the program. Specifically, in the modern competitive timber business, especially SMEs in the region, integrated digital management and promotion systems utilize databases incorporated in governance and automated management systems. The business environment requires fast, efficient and reliable management of huge amounts of information on timber for products, suppliers, customers, materials, machinery, facilities, financial-accounting firm, office support and many more items. Many organizations have supported the idea of marketing using techniques segmentation,

identifying marketing strategies and creating special marketing departments (Tzoulis et.al, 2014a). The online databases have recently emerged as a fairly important component of any company; moreover a database supports the modern concept of marketing as it can gather all the necessary information.

4 Conclusions

Our country has a deficit in wood. Thus, the larger amounts of wood now imported from abroad. Most Greek forests nowadays are "unproductive" forests that mainly produce firewood and only small amounts of technical timber, timber with good quality and without errors. In trade, the species derived from the Greek forests are mostly fir, beech, black pine and poplar (plantation). Previously there was sufficient production amounts and from other wood species, e.g. chestnut, walnut, cypress, ash (ash, honey), elm (elm), pine vitiligo (robolo), juniper (cedar), maple (maple) and linden (lime).It is a fact that the social and economic environment of the era of the crisis and the scale of the threat, in principle generate pessimism about the future of forests in our country. Recent history also teaches us that in all times of crisis the forests had the same major disaster, but objectively helped the survival of people, and some bounced back after improving social and economic conditions. It is therefore expected that, despite the hopes and probably efforts of several national forests already suffer and will suffer a growing extent in the coming years the consequences of crisis. It is up to the individuals and collective associations to adopt the right strategy both to confront the threat and to highlight and capitalize on the opportunity. In the field of exploitation of forests a lot have been achieved so far, and this is due to the development of the science of Forestry and the scientific management of forests. The basic principle of this management is the sustainability of profit participation from the forests. This principle ensures on the one hand the continuous supply of forest products and services and on the other the preservation, maintenance and improvement of forests. Therefore, the adoption of new technological solutions and innovative digital management practices of all data is required, that will provide flexibility, immediate feedback and fast decision-making.

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Acceptance of Energy Crops by Farmers in Larissa's Regional Unit, Greece: A First Approach

Stefanos Leontopoulos[1], Garyfallos Arabatzis[2], Stamatis Ntanos[3], Stavros Ch. Tsiantikoudis[4]

[1]School of Agricultural Technology, TEI of Thessaly, Greece, e-mail: s_leontopoulos@yahoo.com
[2]Department of Forestry and Management of the Environment and Natural Resources, Agricultural Sciences & Forestry School, Democritus University of Thrace, Orestiada, Greece, e-mail: garamp@fmenr.duth.gr
[3]Department of Forestry and Management of the Environment and Natural Resources, Agricultural Sciences & Forestry School, Democritus University of Thrace, Orestiada, Greece, e-mail: sdanos@ath.forthnet.gr
[4]Department of Forestry and Management of the Environment and Natural Resources, Agricultural Sciences & Forestry School, Democritus University of Thrace, Orestiada, Greece, e-mail: stsianti@fmenr.duth.gr

Abstract. The environmental, social and economic consequences of the use of fossil fuels has led to the search for new energy resources, such as energy crops which are expected to contribute in alleviating energy problem while they can lead to the diversification of the agricultural production. This research work investigates the acceptance of energy crops in the Larissa regional unit using questionnaires distributed to a sample of 635 farmers and other landowners (in general farmers) of the area. There is a concern for the establishment of energy crops, as most of the respondents are not willing to cultivate energy plants and also believe that the cultivation of energy crops is very risky.

Keywords: energy crops, farmers, investments, acceptance

1 Introduction

The role of the countryside in recent decades is changing due to the successive reforms of the Common Agricultural Policy (CAP), the enhancement of the environment as an important component in the production process, the globalization and more generally due to the improvement of living standards in rural residents (Anthopoulou, 2001; Arabatzis et al., 2006a; Andreopoulou et al., 2008; Arabatzis et al., 2010; Arabatzis et al., 2011). In particular, successive reforms of CAP and the measures adopted in the last few years have as a result changes in agricultural land use (Arabatzis 2005; Arabatzis et al., 2006b; Arabatzis 2008; Arabatzis 2010). Afforestation of agricultural land may contribute to the production of both technical wood and wood for energy production (fuelwood). Fuelwood is an important source

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of energy production for both developing countries and Greece in the middle of the economic crisis (Arabatzis and Malesios, 2011; Arabatzis et al., 2012; Arabatzis and Malesios, 2013). At the same time several other agricultural plants cultivated intensively for energy production (Leung and Young, 2012).

The use of crop residues for energy purposes compensates the increasing energy demand by enhancing the production of clean energy. Instead, the economic exploitation of residual biomass was favorable only in cultivations with high performance crop residues (Fazio and Barbanti, 2014). Global bio-energy production forecasts for 2050 amounted to 100-450 EJ / year, with 64.78 EJ of them to be produced in Latin America, 43.6 EJ in Africa, 23.55 EJ in Southeast Asia, 26,3 EJ in the EU, 15.89 EJ in the United States, 2.1 EJ in Great Britain and 0.93-4,56 EJ in India (Li et al., 2006; Yan and Chen, 2007).

Currently, the EU is the largest biodiesel producer worldwide (Flach et al., 2013). Italy is the fourth larger producer in Europe after Germany, France and Spain, investing in 19 biodiesel factories, (Palmieri et al., 2014).

According to Panoutsou, (2007) in Greece, the energy crops can be an attractive, alternative solution only if they integrated properly into the existing agricultural activities. However, in the most recent study (Panoutsou, 2008) it was commented that cotton's farmers are more reluctant to replace the cultivation of cotton with energy crops compared with the cereal's farmers. This differentiation is due to the variability of the grain market prices which significantly affect the competitiveness of energy crops in relation to the production of cereals.

The aim of this study was to investigate the acceptance of energy crops from farmers and other landowners (in general farmers) in Larissa regional unit, Greece.

2 Methodology

Larissa regional unit was chosen to be the research area of this study because agriculture is highly developed. According to 2009 agricultural census, the total number of farms in Larissa regional unit was 31,767 (Hellenic Statistical Authority-EL.STAT.). The choice of farmers and other landowners was based on existing lists of EL.STAT. and 2% of 31,767 farms were selected for the questionnaire survey of this study. The survey was conducted with the use of a questionnaire which includes questions on socio-demographic characteristics and questions relating to energy crops. The survey was accomplished in autumn 2014. Descriptive statistics using the statistical program SPSS 20.0 and Excel 2010 used for data analysis.

3 Results

From the data analysis it was found that 84% (534) of the respondents were male and 16% (101) were female. Among them 4.5% (27) were aged between 18-30 years old, 30% (192) were aged between 31-45 years old and 65.5% (416) was over 45 years old. Furthermore, 157 (24.7%) of the respondents were graduates of elementary school, 252 (39.6%) were gymnasium graduates, 166 respondents (26.1%) were high

school graduates, 56 (8.8%) were holders of a graduate degree and only 4 of them had a postgraduate degree.

Regarding professional activity the majority of the respondents 81.2% (516) was professional farmers, 6.4% (41) work in the private sector, 2.4% (15) were employed as freelancers and only 1% (7) work as civil servants. The 8.8% are housewives. Regarding the income of the respondents 44% of them (280 persons) declare income up to 10,000 €, 25.1% (160 persons) declare income from 10,001-15,000 €, 13% and 15.2% (83 and 94 persons) declare income 15,001-20,000 € and 20,001-30,000 € respectively and finally only 2.8% (18 persons) stated an income over 30,000 €. Finally, 82% (520 people) have heard about the concepts of "energy crops" compared with the 18% (115 people) of the respondents which have never heard about energy crops. Energy crops were more familiar to male farmers compared to female.

Regarding the satisfaction of farmers by the price of their agricultural products 23.6% (150 farmers) were “very satisfied” with the prices that their products reach in the market, 38.2% (243 farmers) were “little satisfied”, while 36.8% (234 farmers) were “not at all satisfied”. Eight farmers refused to answer this question.

Concerning the acceptance of farmers surveyed to cultivate energy crops, 76% of them (482) were “not willing to cultivate energy crops”, while 24% (153) would “willing to cultivate energy crops” on their farm.

Only 1.2% (13 farmers) believed that there is “no risk” in cultivating energy crops. However, 11.4% (73 farmers) believed that the establishment of energy crops entails “some” risk, 30.2% (192 farmers) said that cultivation of energy crops has “moderate risk” while 42.2% (268 farmers) agreed that by cultivating energy crops they take “big risk” and finally, 14% (89 farmers) would “avoid the installation” of energy crops.

The 22.2% of the farmers believed that the establishment of energy crops would have an “absolutely positive effect on their income”, while 38.1% (242 farmers) agreed with the view that it “might have a positive effect”. However, 32, 6% (201 farmers) feel that the impact of energy crops on their income is “indifferent”. Finally 8% (51 farmers) believed that the establishment of energy crops would “reduce their income”.

Also, 55.4% (352 farmers) “strongly agreed” that the cultivation of energy crops will have a positive possible impact on the environment. Moreover, 32.4% of the respondents “agreed” with the positive effect of the energy crops on the environment while, only 0.4% of the farmers “disagreed” with this effect. Finally, 74 farmers (11.6%) believed that the impact of energy crops to reduce pollution of the environment is “indifferent”.

Moreover, on the question “whether energy crops are the most important alternative energy source” 57.4% (365 farmers) “strongly agreed” while only 0.9% did “not agree”. Also, important is the percentage (27.7%) of farmers who simply “agreed”. Finally, 88 farmers (13.8%) “neither agreed nor disagreed”.

Furthermore, on the question of “whether energy crops are an alternative source of energy that does not change or destroy the environment”, 3.7% (24 farmers) “strongly agreed”, while 16.3% did “not agree”. Also, important is the percentage (30%) of the farmers who simply “agreed”. Finally, 45.9% of farmers seem not to have a clear view and therefore “neither agreed nor disagreed”.

The 17.4% (111 farmers) “fully endorses” the need to increase the areas of energy crops, while 44.2% (281 farmers) “agree”, 6.6% (42 farmers) “disagree” with the increase of land used for energy crops. 31.6% (201 farmers) seem not to have a clear view (neither agreed nor disagreed).

4 Discussion - Conclusions

The acceptance of energy crops from Larissa’s regional unit farmers as alternative crops is depending on many factors. One of them is the ability of selling their produced agricultural products in acceptable price. Furthermore, factors such as the technological exploitation of domestic industries and their acceptance by consumers (Ulmer et al., 2004) are also important. Similar results have been observed from a study which involved among other things, prospects of job offer increment and the existence of subsidies in terms of State (Delshad et al., 2010; Cacciatore et al., 2012).

The cultivation of energy plants has very little acceptance in Larissa regional unit, Greece. The majority of farmers were male and over 45 years old. Most of the respondents were not willing to cultivate energy plants although energy crops believed to be used as an alternative energy source. The farmers knew the concepts of "energy crops" and "energy plants" and most of them believed that the establishment of energy crops is very risky.

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Integration of GIS & GPS Systems on Vehicle Monitoring

Afërdita Qekaj-Thaqi[1]

[1]MSc., PhD. Candidate, Economics-Management Information Systems, European University of Tirana, Albania, e-mail: aferdita06@gmail.com; aferdita.qekaj-thaqi@kosovopolice.com

Abstract. Continuous technological development of information systems provide an extensive range of services impacting on upgrading performance and diminishing expenses by utilizing GPS system on vehicle monitoring. Due to positive impact, GPS utilization has been widely applied into the many government departments and institutions, meanwhile used from private businesses, as well. Services derived from usage of information technology, bearing efficiency and beneficiaries of gadgets, resulted on solid increment of the interest and special focus towards multitasking utensils and IT systems in different areas. GIS provides monitoring functions via visual display of information on spatial data and precise geographical positioning of monitored vehicles, whilst GPS presents accurate, clear and precise information upon position and navigation of monitored or tracked vehicle just in time and exact location. Efficiency of GIS and GPS on vehicles monitoring and tracking have also been extensively used emphasizing law enforcements- police and military services.

Keywords: GIS, GPS, Monitoring, technology, information system, police, military.

1 Introduction

With enhancement of technology particularly of information systems, demand for such devices have been profoundly increased worldwide. Cause for increased demanded occurred due to the offer of miscellaneous gadgets thru which operations costs are massively diminished. Efficiency, accuracy, cut on spending, ease on communication, availability of immediate data collection, quick retrieve of information, reliability, and other immense benefits are among potent patterns shown to be provided from information technology devices which ignited wish of almost entire private and public entities inclinations towards and being keen on prompt implementation into their daily operations. Recent years government institution were not left behind on race for information technology neither, meanwhile they leaped towards trying hard to implement technology systems into their routine daily operation. So far, private firms and companies were slightly ahead as it comes in their restless searching for information technology innovations. Therefore, amidst information technology innovations GIS system emerged as a novelty of technology

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back in late 1960s. Ever since system is updating on accuracy and massive data completeness, thus, demands for GIS system are persistently increasing

The term Geographic Information System (GIS) was introduced by Roger Tomlison and was used later promoted by professors at Harvard University in the 1970s, inspiring several geographic consulting companies to develop and expand GIS technology. Local government and businesses started deploying large GIS operation systems in the early 1990s and soon it became clear that the success of such distributed GIS operations was strongly connected with understanding of its performance and scalability in a distributed computer environment (Peters, 2008, 5).

Through the years, innovation and improvements on technology reached higher levels. Invention of wireless enhanced and pushed even further utilization of technology systems. Remote control of objects, pattern of wireless technology, penetrated deeply in today's life making communication easier, faster and cheaper at the same time. Wireless technology is in series of utensils and gadgets been used for GIS and GPS integration into operation systems, as well.

Knowing crucial functions of GIS as an system, it started being broadly implemented besides private firms and businesses, it has been also integrated into many government agencies, different institutions, police services and military forces, respectively.

Therefore, intention of this scientific paper is to provide range of function and operation features of GIS and GPS, it necessary application on monitoring and tracking of moving vehicles. For wide comprehensive understanding purposes qualitative methods has been used depicting facts and figures supported from carefully chosen literature about topic of the paper.

2 GIS & GPS Systems

Integration of GIS and GPS devices make available mobile communication easier using latest wireless technology. Both GIS and GPS devices have their own components which combined together provide high powered network which is mainly used for remote real time communication. GIS has the function to manage large amount of data and it is used to display geographically information on map that are massively accepted for digital maps. GPS enables collection information about the location of a vehicle or an object. GPS is the only system today that can show exact position on the Earth anytime, in any weather, no matter where the person, vehicle or any object is located. Prior to showing the attributes of utilization of integration of GIS and GPS systems, I'll briefly show components of systems having better picture of gadgets and their most important functions.

3 Components of GIS

GIS is defined as system of hardware, software, and procedures designed to support the capture, management, manipulation, analysis, modeling and display of

spatially referenced data solving complex planning and management problems (Cowen, 1988).

An operation of GIS has also series of components that combine to make the system work. GIS is consisted of five important components, computer hardware, sets of application software modules, required data, people who manage the system and develops plans, and a well designed implementation methods. Those critical components of GIS are:

1. Hardware - is computer system on which a GIS operates. A GIS relies on a computer for storage and processing data. GIS needs a personal computer to run on. In addition to computers, as variety of other devices can be used to capture and feed data into the system. Scanners and digitizing tables are used to scan existing paper maps, charts and drawings into the system. GPS receivers are used to create map features in the field and transmit the current location of moving vehicles.

2. Software - provides the functions and tools needed to store, analyze and display geographic information. The core of any GIS systems is based in the its own software providing the functionality to store, manage, link, query and analyze geographic data. In addition to the core, various other software components can be added to GIS software to provide access to additional sources of data and forms of functionality.

3. Data - A GIS can integrate spatial data with other existing data resources often stored in a corporate DBMS. Data for GIS comes in two forms: Geographical and spatial data and attribute of spatial data. Spatial data are data that contains explicit geographic location in the form of a set of coordinates. Attribute data are descriptive set of data that contain various information relevant to particular location, depth, height and sales figures, and can be linked to a particular location by means and identifier as for instance an address or a zip code.

4. People - the main objective of a GIS is to support its users with appropriate data and decision support tools. Thus, careful consideration of particular needs of the users must be given at the design stages of the system, so that each group of users will be given access to the data and functionality of the system in the most appropriate way. A system must be highly accessible and usable otherwise it may not be used efficiently or even it may not be used at all.

5. Methods - A successful GIS operates according to a well-designed implementation plan and business rules, which are models and operating practices unique to each organization. As in all organizations dealing with sophisticated technology, new tools can only be used effectively if they are properly integrated into the entire business strategy and operation, therefore it requires necessary investments in hardware and software meanwhile it requires hiring of personnel to utilize the new technology in the proper organizational context (Gopi, Sathikumar, Madhu, 2007).

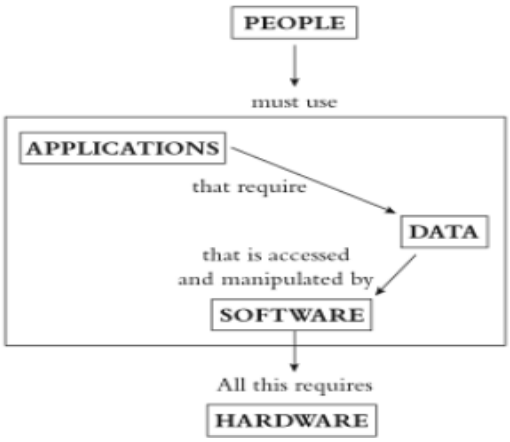

Fig. 1. Components of GIS. *Source: "The Design And Implementation Of Geographic Information Systems"*

4 Components of GPS

The Global Positing System is comprised of the three main components are followings:

1. The GPS tracking system satellites - GPS tracking system is an aerospace technology comprising of at least 24 operational satellites at all times. Each satellite is on a circulate orbit 20,000 kilometers above the Earth on a 12-hour period. In order to make sure that these satellites are detected from anywhere on the surface of the Earth, the satellites are divided into six groups four space vehicles each which are assigned a different path to follow. The orbit is such that GPS satellites recapitulate the same ground track and configuration at approximately over any point each in 24 hours.

2. The GPS Tracking System Equipment on the Ground - ground stations are used so that each satellite orbit is accurately tracked. The GPS tracking system has ground stations which is comprised of a receiver and antenna, as well as communication tools to transmit the data to the data center. When the GPS satellites supply specially coded signals, the Omni-directional antenna at each site picks up the signals and that is processes in a receiver. The receiver then separates the signals in various channels for particular satellite and frequency at a particular time. Once signals are isolated, the receiver now decodes them and splits them into individual frequencies to calculate position, velocity, direction and time anywhere on the Earth.

3. The GPS receivers - The GPS receiver is the endeavor of the complete system the receives the signal that is sent directly from the satellites to nail your location and get you pre-programmed direction. The device is usually mounted on the dashboard of the car or with a suction cup to the screen. It has a registering cover that

instrument present to the line to go and several GPS receivers verbalize phonation cues to get person, vehicle or any object along the path. (GPS made easy).

Fig. 2. How Real-time GPS tracking works. *Sources: LandAir Sea*

5 Features and Users of GIS & GPS Systems

Geographic Information systems (GIS) are "smart maps." They are smart because they are tied to databases and they know exactly where are on the face of the earth. They, GIS maps, can also perform feats such are values summation, neighborhood evaluation, and buffering (Hanna, Culpepper, 1998, 7). GIS is a highly specialized technology of interest to professional users and researches for specific applications. One the major driving force behind the recent popularization of spatial information is the increasing availability of spatial data from government and commercial sources, distributed via internet through such mechanisms as spatial data depots, digital geo-libraries and spatial data warehouses and clearinghouses. Another major driving force is the growing awareness of the importance of spatial information by all sectors of modern society.

The number of disciplines that that use GIS in some form or other has increased dramatically in recent years. GIS developed from analysis which is why the first and more traditional disciplines adopted GIS and many other disciplines are seen as potential users of the system including: geology, geophysics, oceanography, agriculture, biology, environment sciences, geography, sociology, political science and anthropology. Other examples within business include the transportation industry and the taxi trade. In recent years the local government sector has started to use web-based GIS services that citizens can use (Grinderud, Rasmussen, Nilsen, 2009, 38-39).

Along GIS amongst the mostly utilized technological devices we can firmly state that it's GPS. Although GPS was originally designed as military system, its civil application grown faster. On the surveying side, GPS has replaced the conventional methods in many applications. GPS positioning has been found to be a cost-effective process in which 50% cost reduction can be obtained whenever it is with conventional techniques. In terms of productivity and time savings it could provide more than 75% time saving whenever it is possible to use GPS methods. GPS has numerous applications in land, marine and air navigation, while in vehicle tracking and navigation are rapidly growing. Future of GPS users of GPS will include automatic machine guidance and control where hazardous areas can be mapped efficiently and safely using remotely controlled vehicles (El-Rabbnany, 2002, 10-11).

6 Integration of GIS/GPS systems for police vehicle monitoring

Recent development of technology made it possible spatial databases systems being used in relatively sophisticated ways in many private and public institutions including law enforcement departments such are police sector. Spatial data system or GIS could go beyond the simple management, by displaying and analyzing of geographically referenced information. A typical spatial database system is enhanced by capabilities to manipulate new data types and models, complex data structures including spatial indexes, sophisticated algorithms and operators for efficient data processing. The increase reliance of spatial database on the internet and related technologies has led to many innovative methods of communicating spatial information (Albert, Yeung, Hall, 2007, 6-7).

While role of GIS is to provides mapping of certain location and precise spatial information, GPS on the other hand provides many functions that helps monitoring and tracking police officers while outdoor. In general, main objective of integrating GPS is done due to multiple functions of device on assisting and easing daily police force operations. Monitoring or tracking of police cars provides better service to their local community. Via GPS can be identified cars are commuting closest to a crime scene and ensure that police officers stay within their assigned zone. Tracking of the police cars as also done for internal use. Among objectives of using GPS on monitoring police service vehicles are:

- Recording of route and movement of police car - having in mind that police officers do have their own route to pass, in some cases it is necessary to monitor road the car paths since any emergency case can be better managed having accurate and precise vehicle position under monitoring,
- Velocity of movement - depicts the way police officers behave under certain route conditions,
- Fuel expenses - measurements of fuel expensed may lead to managing of main expense that police car make. this function of GPS helps police officers having knowledge about the car's engine conditions by providing evidence in circumstances of increased fuel expenses due to the engine problems, for instance.

- Number of people (passengers) sitting on car - GPS sensors are installed in order to identify number of people or passengers on car.

- Filling fuel - sensors identify amount or gallons poured into fuel tank, time and place is also recorded. By having this data police officers will have information about the particular car how much fuel remained just by looking into the records provided by GPS at the time they decide to take a car for a drive,

- Starting and stopping time of vehicle - 5 seconds after the car is turned on, signal is sent showing car is ready for use and assist on fuel expenses management. Information supplied shows time car has set and " idle" time meaning car stand on place with turned engine on but it was not driven.

- Parking of vehicle - place and time vehicle was parked. Trying to avoid shirking of police officers, monitoring will proof for reliability and time spent while on duty.

- Seeking for vehicle - in case of any accident or any "force majeure" disaster (earthquake or flood), GPS makes possible monitoring cars in such occasions by shortening time for rescuing police officers from disaster or accident.

- Speed limit - in many circumstances police officers are ought to speed up while driving aiming to catch wrongdoers. In rare cases monitoring can be used showing if any of officers "intentionally" disobeys rules,

- Plates - GPS automatically shows plates of car strolling. This information helps identifying which car is taking particular route.

- Car identification - name of driver and his/her colleagues is identified. In case of any emergency or any duty call, car identification depicts if officers are on proper route, driving meticulously, their location, any plenty additional information according certain vehicle.

7 Conclusion

GIS and GPS systems have been proven as highly efficient, ease to be handled, communication facilitators, reliable to be used. With such pattern shown, implementation of systems found to be utilized from private companies, enterprises, agencies, government agencies, and law enforcement as police services and military forces. Continues technological improvements triggered demand on gadgets to increase, as it does for GIS and GPS systems. Deployment of systems is persistently increasing by integrating them into government and law enforcements, particularly on police service sector. Implementation in police services is the proper and suitable since integration of both devices provides perfect combination needed on assisting police officers. Reason relies on that since GIS system provides monitoring functions via visual display of information on spatial data and precise geographical positioning of monitored vehicles and GPS presents accurate, clear and precise information upon position and navigation of monitored vehicle in exact time and location.

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Research & Development Session

Effect of Auxins on Mechanical Injury Induced Oxidative Stress in *Prunus sp.* Rootstocks

Milan Popović[1], Đorđe Malenčić[1], Dejan Prvulović[1], Biljana Kiprovski[1], Aleksandra Popović[1], Dušica Dorić[1]

[1]Faculty of Agriculture, University of Novi Sad, Trg D. Obradovića 8, 21000 Novi Sad, Serbia, e-mail: dusicab@polj.uns.ac.rs

Abstract. The effect of exogenously applied auxins on oxidative stress was studied in six rootstock selections of *Prunus cerasus*, *P. mahaleb* and *P. fruticosa* aiming at the effect of phytohormones on the level of the lipid peroxidation (LP). Standard rootstock PHL-A was used as a control. Leaves were collected on 0, 1st, 3rd and 7th day of inserting cuttings into the rooting substrate. Auxin mixture consisted of 0.8% α-naphthylacetic acid and 0.5% indolebutyric acid. Differences in intensity of the LP between auxin-treated and -untreated cuttings were examined. Almost all of investigated selections had lower LP intensity after auxin application (11.4-47.2%). The most prominent change was in leaves of PHL-A (49.2%). LP-lowering effect were recorded in leaves of *P. fruticosa* (56.9%) on 7th day and in *P. mahaleb* on 1st and 3rd day (5.9, 5.8%). Intensity of LP could be used as one of the biochemical parameters in further rootstock selection and production.

Keywords: *Prunus* sp. rootstocks, softwood cuttings, auxins, oxidative stress, lipid peroxidation

1 Introduction

Rootstocks should be adapted to environmental conditions, expected to be easily propagated, to result in uniform fruit tree behavior in the orchard. Selection success in breeding of vegetative rootstocks for sweet and sour cherry is dependent not only on genetic variability, but also on expediting propagation processes as a precondition for investigation of special combining abilities between rootstock and scion (Bošnjaković et al., 2012; Bošnjaković et al., 2013). To expedite propagation of rootstock selections, propagation by softwood cuttings is preferable.

Oxidative metabolism of normal cells and different stress situations generate highly reactive oxygen species (ROS). The ROS, such as, superoxide radical ($O_2^{\cdot -}$), hydrogen peroxide (H_2O_2), hydroxyl radical (·OH), and singlet oxygen ($^1O_2$) have been implicated in a number of physiological disorders in plants (Malenčić et al., 2012; Blomster et al., 2011), which in turn leads to a decrease in plant productivity. To prevent oxidative stress, plants have evolved a complex antioxidant system composed of non-enzymatic and enzymatic mechanisms that scavenge ROS (Casano et al., 2004; Malenčić et al., 2010). The formation of auxins conjugates may serve as

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a protection against oxidative degradation (Taiz and Zeiger, 2006). Antioxidant defense systems have co-evolved with aerobic metabolism to counteract oxidative damage from ROS. A ROS signal can be generated in a group of cells in the plant in response to wounding, pathogen attack or a local abiotic stress, and be transferred to the entire plant. The integration of ROS with auxin signaling networks, triggered by environmental factors, is known as the stress-induced morphogenic response. In this response, ROS and auxin metabolism interfere and lead to morphological changes that help avoid deleterious effects of environmental stress (Mittler et al., 2011).

Lipid peroxidation (LP) is a natural metabolic process occurring in aerobic conditions and presents the most investigated effect of ROS on structure and function of cell membrane. Thus, the aim of this study was to measure the intensity of LP in the leaves of six cherry rootstocks selections in order to investigate the effect of exogenously applied auxins on the oxidative stress induced by mechanical injury during rooting of softwood cuttings.

2 Material and Methods

The effect of exogenously applied auxins on mechanical injury induced oxidative stress was studied in six rootstock selections: *Prunus cerasus* L., (OV21, OV22), *P. mahaleb* L., (M4, M6) and *P. fruticosa* Pall. (SV2st, SV4). Standard vegetative rootstock-PHL-A was used as a control, due to successful rooting. Softwood cuttings of investigated selections were collected from *ex situ* mother trees from the experimental field of the Faculty of Agriculture at Rimski Šančevi, near Novi Sad. The experiment was carried out in a plastic house under a fogging system with 95-98% relative humidity in average. The rooting substrate was a blend of white sphagnum and perlite. The 15-20 cm long terminal cuttings were treated with exogenously applied auxin mixture consisted of 0.8% α-naphthylacetic acid (NAA) and 0.5% indolebutyric acid (IBA). Leaves of investigated rootstocks were collected on 0, 1st, 3rd and 7th day after cutting and inserting softwood cuttings into the rooting substrate. Experiment was carried out with a total of 60 softwood cuttings per selection (30 auxin-treated and 30 auxin-untreated cuttings).

As a measure of LP intensity, the amount of malondialdehyde (MDA) was determined spectrophotometrically by the thiobarbituric acid-reactive-substances (TBARS) assay (Hodges, 1999). Leaves of softwood cuttings were first homogenized and then extracted in 10% trichloroacetic acid (TCA) in ratio 1:5 (w/v) and centrifuged at 12000 x *g* for 30 min at 4 °C. One cm^3 of supernatant was incubated with 4 cm^3 20% TCA containing 0.5% TBA for 30 min at 95 °C. The reaction was stopped by cooling on ice for 10 min and the product was centrifuged at 10000 x *g* for 15 min. The absorbance of the TBARS was measured at 532 nm and 600 nm and their concentration was determined using the MDA extinction coefficient of 155 mM cm^{-1} and expressed as nmol MDA g^{-1} fresh weight.

3 Results and Discussion

The present investigation showed that the oxidative stress induced by mechanical injury in the leaves of rootstock selection of sweet and sour cherry, characterized by an accumulation of MDA, may be attributed to the genotypic differences in wounding tolerance. Results of Malenčić et al. (2012) showed a positive effect of exogenously applied NAA on LP-lowering effect in standard vegetative rootstock Gisela 5, as well as in four investigated sweet and sour cherry rootstocks selections. Similar was recorded for standard rootstock PHL-A in our experiment where a positive auxin effect on lowering LP intensity was noticed between 1st and 3rd collecting day, but on 7th day, an increase of LP was 65% compared to control (Fig. 1). In *P. mahaleb*, selection M4, MDA production was significantly lower in auxin-treated cuttings on 1st and 3rd collecting day. On 7th day LP intensity was similar in auxin-treated cuttings of both *P. mahaleb* selections, M4 and M6 (24.2% and 2.5%, respectively), comparing to untreated cuttings (23.9%, 5.5%) (Fig. 2 and Fig. 3). The enhancement of MDA accumulation, a cytotoxic product of lipid peroxidation, was recorded in *P. fruticosa* selection SV2 on 3rd collecting day in both treated and untreated cuttings, contrary to 7th collecting day where auxin application showed lowering effect on LP intensity (Fig. 4). Lowering effect on LP intensity was noticed on 1st and 7th day in SV4 selection, also. Higher degree of membrane damage was noticed in untreated cuttings on 7th collecting day (154.5% of control) (Fig. 5).

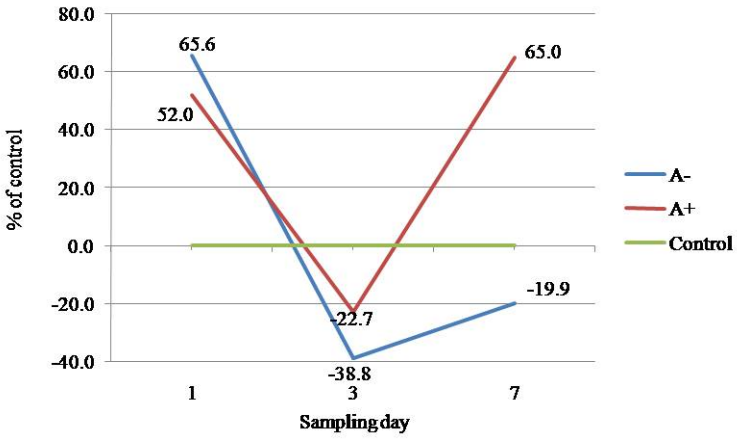

Fig. 1. LP intensity in auxin treated and untreated standard vegetative rootstock PHL-A

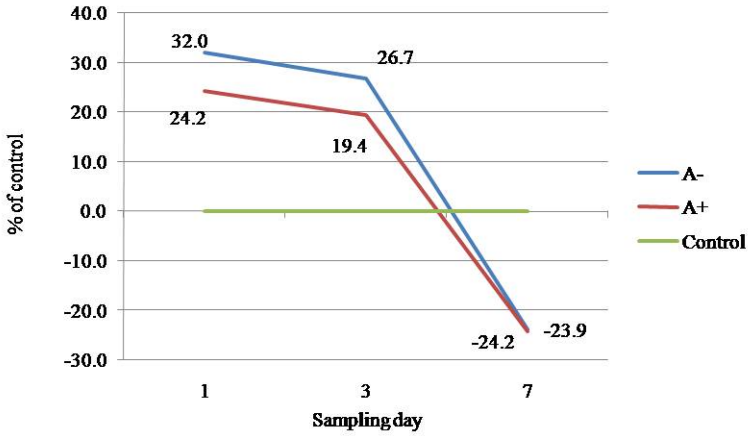

Fig. 2. LP intensity in auxin treated and untreated rootstock selection *P. mahaleb* - M4

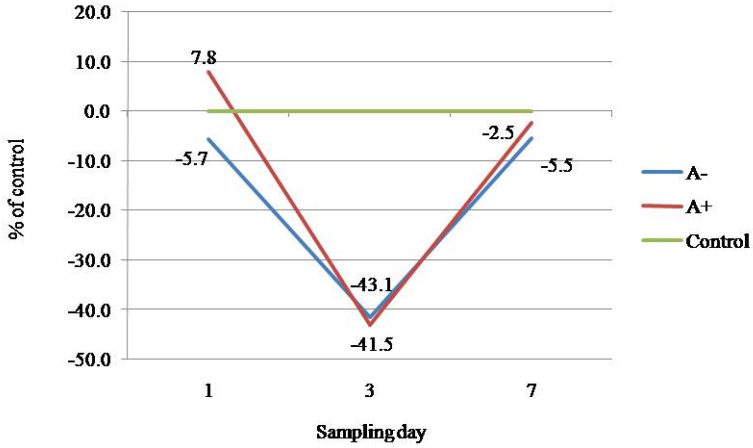

Fig. 3. LP intensity in auxin treated and untreated rootstock selection *P. mahaleb* - M6

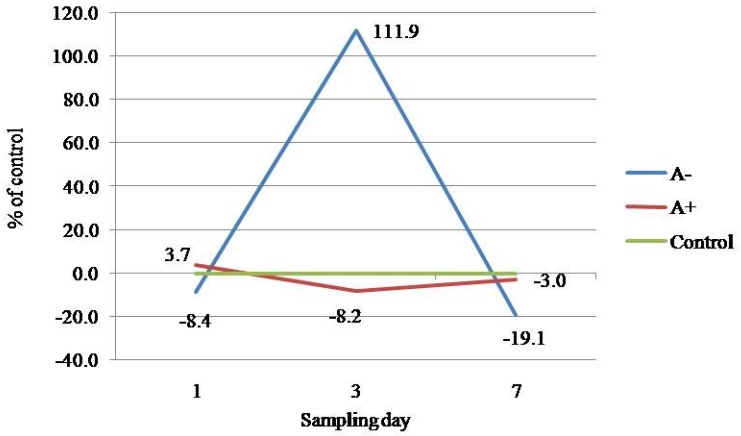

Fig. 4. LP intensity in auxin treated and untreated rootstock selection *P. fruticosa* - SV2

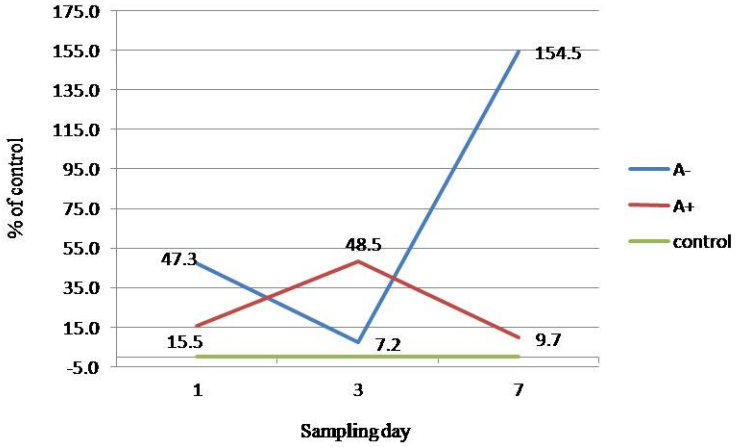

Fig. 5. LP intensity in auxin treated and untreated rootstock selection *P. fruticosa* - SV4

According to Cheong et al. (2002), wounding negatively regulates IAA responsive genes, revealing a new level of crosstalk between wounding and auxin response in plants. Studies of expression patterns of genes regulated by wounding provided new information on the interactions between wounding and other signals, such as pathogen attack, abiotic stress factors, and plant hormones.

A great genetic variability in response of rootstocks of *Prunus cerasus* L., *P. mahaleb* L. and *P. fruticosa* Pall. toward wounding and oxidative stress was established. Despite the fact that auxin has a positive effect on rooting and LP-lowering effect in most of treated selections, its application seems to has no universal LP-mitigating effect for treated rootstocks. Among all investigated selections, the

best auxin LP-lowering effect was in *P. mahaleb*, M6 selection during the entire experiment. Also, the results gained from LP assay proved to be invaluable marker for resistance to the oxidative stress induced by mechanical injury and impact of propagation in sweet and sour rootstock selection.

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Biomass On-line Management System: BI.O.MA.S.

Christos Stefanis[1], Eleni Kamateri[3], Maria Partalidou[2], Stelios Gargas[4], Kostas Nasias[5]

[1] Aristotle University of Thessaloniki, Department of Food Science and Technology, Thessaloniki 54124, Greece, e-mail: cstefan@agro.duth.gr
[2] Aristotle University of Thessaloniki, School of Agriculture, Dept. of Agricultural Economics, 54124 Thessaloniki, Greece, e-mail: parmar@agro.auth.gr
[3]Nasias K. & Co LP (EXEO), 54352, Thessaloniki, e-mail: ekamater@hotmail.com
[4]Nasias K. & Co LP (EXEO), 54352, Thessaloniki, e-mail: steliosgargas@gmail.com
[5]Nasias K. & Co LP (EXEO), 54352, Thessaloniki, e-mail: nasias@exeo.gr

Abstract. A new tool that will exploit the benefits of ICT technology and promote biomass entrepreneurship is presented: BI.O.MA.S. This new approach is based on a web-based tool for the real-time biomass supply chain management, an online marketplace combined with an auction platform for biomass products/services and the release of an app for smartphones and mobile devices. The goals and the novelty of Biomass-On-line-Management-System (BI.O.MA.S.) will be the creation of an integrated, online system which will help the interactions between the several actors of the biomass market and the agricultural sector, contribute to domestic and international bioenergy trade, and increase business-to-business, business-to-consumers and e-commerce in agriculture.

Keywords: biomass, energy, agriculture, e-commerce, e-auction.

1 Introduction

Over the past decades energy from biomass has been on the cutting edge of research in renewable energy. This is expected to be doubled in next decade. Moreover, the biomass production for the generation of bioenergy still encounters several issues that have to be addressed. The biomass supply chain comprehends of diverse and independent procedures including production of biomass, collecting, storage, transportation to the point and eventually energy production (J.E Iakovou E et. al. 2010; Sharma B et. al. 2013).

Currently, there are several biomass trading systems. Notwithstanding, most of them do not focus on small-medium biomass stakeholders, do not aim to train or motivate the biomass community towards the environmental and social benefits of agriculture. Also, they lack a user-friendly interface and do not work properly on mobile devices. Towards this direction we aim to developing BI.O.MA.S. an integrated, online system for the real-time management and auctioning of the

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biomass products and services. Besides a web-based platform, BI.O.MA.S will be available as a mobile app.

2 Architecture

The BI.O.MA.S. architecture will introduce a scalable and modular approach for facilitating the design, deployment and execution of the BI.O.MA.S. functionality on top of an integrated platform. It comprises of three horizontal layers: the Presentation Layer, the Application Layer/Business Intelligence and the Data Layer (Figure 1). Each layer comprises a set of FIWARE and new components (addressing the specific needs of the project).

The core environment will be developed using the Marketplace – WMarket enabler. The Marketplace will provide functionality necessary for bringing together offering and demand for making business. It also provides a Pricing Simulator Decision Support feature (Pricing Simulator Tool) that supports the decision-making processes. The IaaS Resource Management enabler will enable BIOMAS to address the increasing needs on computing resources (scalability) required for the real-time performance of the BI.O.MA.S. platform in order to store data and perform powerful analytics. POI (Points of interest) GE will be used by BI.O.MA.S to enable users to run location-based search queries. The Identity Management – KeyRock enabler will be used in order to reduce the effort for account creation and management ensuring the users' privacy. The Object Storage is object-based storage container which can be efficiently used as the storage of the marketplace's data (product descriptions, profiles, actions, events, statistics, etc.) and informational content (tutorials, videos, user manuals etc.). The revenue model of the BI.O.MA.S system will be managed by RSS GE. It will publish to inform when users or agreements exceed predefined targets, upcoming events etc.

Apart from mentioned GEs, the BI.O.MA.S project will develop (from scratch) new components. The Biomass Storage and Logistics module will help users to implement and maintain a storehouse of biomass products and services. Logging/auditing module will keep track and display previous for each user. The Collaboration module will help different actors to collaborate and combine different services/products. Trend Analysis and BI module provides data analysis and business intelligence support to users enabling them to define their pricing policy, make predictions and decide where to invest. Finally, the Event Planning Calendar module will be used to plan user activity and future business transactions, services/products delivery, opening of new auctions etc.

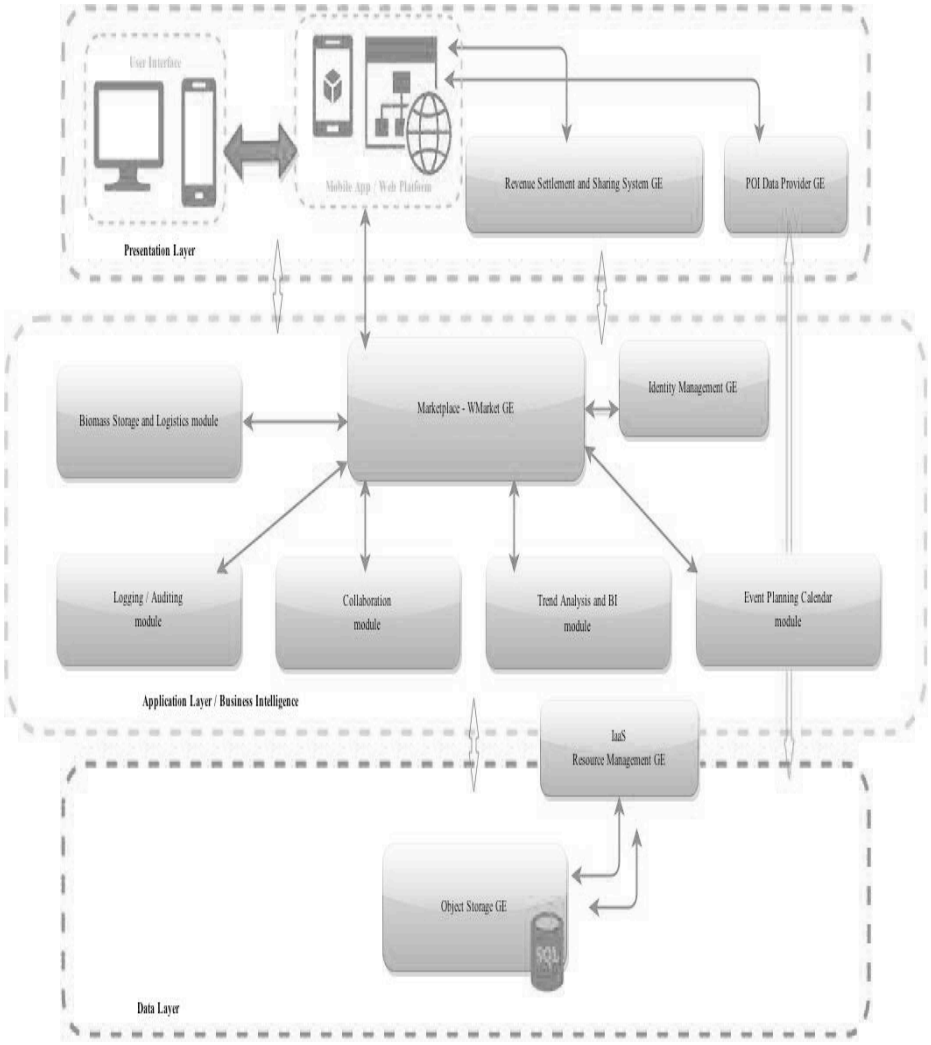


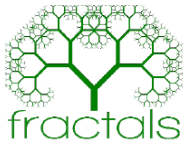
Fig. 1. The architecture of BI.O.MA.S. platform and FIWARE technologies usage.

3 Conclusions

In this paper we present the architecture of an online marketplace and auction platform for biomass products and services via the usage of FI-WARE technology. Moreover, the additional design of five new components specially developed for project's purposes will offer new added-value functionalities and advances such as real time-auctions, event planning calendar, location-based searching, history monitoring, statistics and trends analytics. Compared with existing solutions,

BI.O.MA.S. will offer a trading solution that will enable small and medium biomass players to enter the biomass market. Subsequently, we plan, as future work, to expend the supported features and properties of biomass products or extend the platform to support other agricultural products.

Acknowledgments. This project is funded by FRACTALS (Future Internet Enabled Agricultural Applications, FP7 project No. 632874), under the funding framework of the European Commission".



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Applying Earth Observation Data for Detection and Estimation of Woody Biomass Volumes of Agricultural Areas Accessible for Energy Production

György Fülöp[1], Edit Sárközi[1], Ildikó Szikszainé Szigeti[1]

[1]GeoData Services Ltd., Hungary, e-mail: geoadat@geoadat.hu

Abstract. The need for renewal energy supply is increasing due to EU2020 aims. At the same time, agricultural areas in rural regions of Central and East Europe are being abandoned due to urbanization processes. Uncontrolled landuse changes after abandonment are leading to spontaneous growth of biomass, which is resulted by the spread of weeds and opportunistic invasive species. Our EUREKA financed technology development project aimed to provide information about the location, the volume and the dynamic tendencies of these biomass sites in order to make them operatively accessible for utilization in (bio-) energy supply. In Northern-Transdanubia we located with satellite imagery over 3000 agricultural areas with over 8000 ha area, which are affected with woody increment. In local sample regions we carried out biomass volume estimation with the integrative utilization of Copernicus Sentinel-1 imagery.

Keywords: biomass, rural regions, Earth Observation, Sentinel-1, detection, volume estimation

1 Introduction

T-BEA (Tool for Biomass Energy Accessibility) project (EUREKA, 2015) is a development project supported by EUREKA Programme, carried out with the coordination of GeoData Services Ltd. (Hungary), partnering Gauss Ltd. (Romania). The aim of the project is to develop operative technologies for the detection and volume estimation of spontaneously up-growing woody biomass in agricultural areas. The project targets the synergies between fighting against harmful land use changes and sustainable supplying of raw material resources of bio-energy production. Since the project approaches to its end, this publication intends to summarize the technical achievements, and to give an overview of the already operational new services.

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2 Earth Observation – Background Technology

T-BEA project utilizes high-tech data source of Earth Observation for the detection and volume estimation of biomass stocks. The actuality of the development project emerges from the new availability (since October 2014) of Copernicus Sentinel-1 datasets. The C-Band synthetic aperture RADAR sensor provides entire Europe coverage every 12 days (6 days with near future Sentinel-1/B satellite pair).

Due to the all-weather quality and the sensor's independence from daylight conditions, Sentinel-1 datasets provide unprecedented opportunity for biomass monitoring and volume estimation (Figure 1). We utilized the fusion of Sentinel-1 (12,5 m spatial resolution) and Landsat-8 OLI (15 m spatial resolution) for the technology test and demonstration.

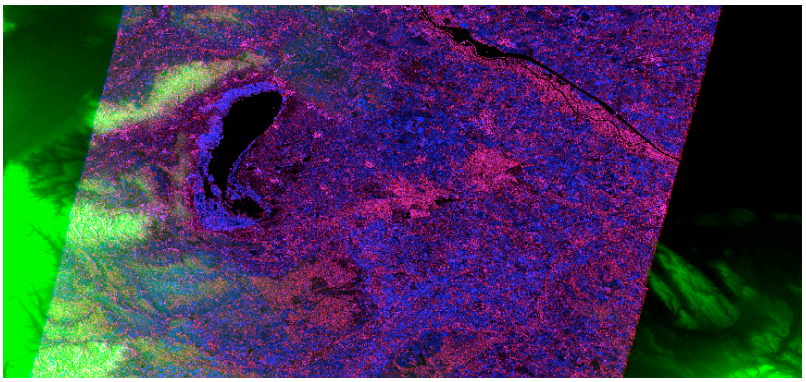

Fig. 1. Sentinel-1 data (VH and VV channels above DEM) of Northern-Transdanubia.

3 Results – Detection and Volume Estimation Statistics

With the utilized datasets we have detected (Fülöp et al 2015) in the test region (28 750 km^2) more than 3000 abandoned, biomass-containing agricultural sites, with more than 8000 ha. After sampling validation more than 85% of the detected sites were plausible. The mean site area is 2,38 ha (st. dev 0,56 ha).

During the in situ validation, in case of more than 75 sites also biomass estimation was carried out with 10 t/ha resolution. These training information were used for the development of the volume estimation technology, which is relying on the regression between the ground-truth volume values and the Earth Observation digital values.

The Earth Observation datasets – consisting of more than 35 layers - were setting up five significant factors. Between the factors and the ground-truth information regression were built (Table 1). The Stepwise method lead to the inclusion of three factors, while the overall power of the model was over limit (0,705 R-square), which allowed us to use the model for biomass estimation with an average 31 t/site - thus 13 t/ha – reliability in the first round.

Table 1. Volume estimation regression model built from training test sites

	Unstand. Coeff.		St. Coeff.		
	B	SE	Beta	t	SL
Const.	72,988	6,349		11,497	,000
cl4f1	-,531	,157	-,368	-3,390	,001
cl3f2	,793	,146	,441	5,450	,000
cl8f3	,678	,310	,240	2,186	,033

4 Application and Model Development

The T-BEA estimation information is being operatively utilized by biomass energy production industry organizations, for the planning of biomass harvest. The model is recursively developed (recent number of training sites: 205) with the accurate information of the mined biomass volumes. Due to this precision within-site biomass categorization has begun (Figure 2).

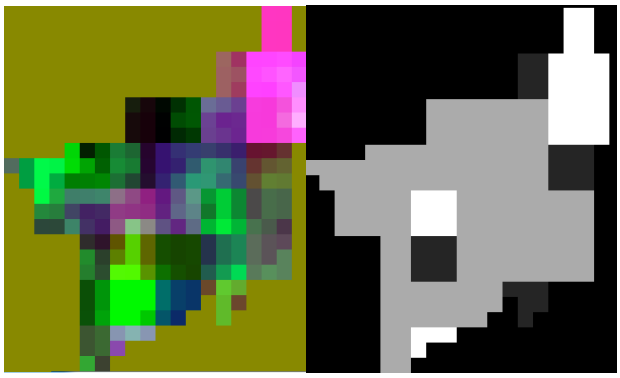

Fig. 2. Abandoned agricultural site (2,5 ha) in the raw imagery fusion (Landsat OLI and Sentienl-1); woody biomass categorization (5 operational management categories)

Acknowledgments. We are thankful for the support of EUREKA Programme (E!7651), and the project partnering efforts of NFKIA (Hungarian National Development, Research and Innovation Office) – EUREKA_HU_12-1-2012-0042.

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Direct Regeneration of Chickpea (*Cicer arietinum L.*) from Adventitious Buds

Salem S. Alghamdi[1] and Megahed H. Ammar[2]

[1]Legume Research Group, Plant production Department, Faculty of Food and Agricultural Sciences, King Saud University, P.O .Box 2460, Riyadh 11451, Saudi Arabia, e-mail: salem@ksu.edu.sa

[2]Legume Research Group, Plant production Department, Faculty of Food and Agricultural Sciences, King Saud University, P.O .Box 2460, Riyadh 11451, Saudi Arabia

Abstract. The seeds of ten different genotypes of chickpea (*Cicer arietinum L.*) originated from Egypt, ICARDA and Saudi Arabia, were used to screen their tissue culture response on various media combination. MS media supplemented with 1, 2 and 4 mg of each of IBA and trans- zeatin /l, were tested. The results showed that stem results were far better from leaves explants. The callus induction ranged from 6.98% for Giza 4 to 100% in Line 221. The genotypes Giza 4, Giza 88, Giza 195, and Giza 531 proved to be the most responsive genotypes in direct shoot formation. It is clear adventitious buds for direct regeneration and multiple shoot formation was the best explant that produced multiple shoots within 4-5 weeks period. However, callus induction trial using stem explants showed also acceptable response. In contrast, leaf explants were very poor in response and were severely affected by phenolic components secreted in growth media. The 4-6 cm long shoots were transferred to rooting media on NAA and IBA at concentration of 0.5, 1.0 and 2.0 mg/l. roots were successfully produced 3-4 weeks and complete plantlets were established. Callus induction and subsequent embryogenesis were limited to genotypes Giza 1, Giza 195 and Line 221as they gave the highest callus induction response.

Keywords: Chickpea, Direct shoot formation, growth regulators

***Note**: Upon request by the author, only the abstract of this paper is published to the proceedings. You can contact directly the author for more information regarding this paper.*

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A Stochastic Simulation Model for the Efficacy of Vaccination Against *Mycobacterium avium* subsp. *paratuberculosis* in Dairy Sheep and Goats

Polychronis Kostoulas[1], Elissavet Angelidou[2], Leonidas Leontides[3]

[1]Laboratory of Epidemiology, Biostatistics and Animal Health Economics, Faculty of Veterinary Medicine, University of Thessaly, Greece, e-mail: pkost@vet.uth.gr
[2]Laboratory of Epidemiology, Biostatistics and Animal Health Economics, Faculty of Veterinary Medicine, University of Thessaly, Greece, e-mail: eaggel@vet.uth.gr
[3]Laboratory of Epidemiology, Biostatistics and Animal Health Economics, Faculty of Veterinary Medicine, University of Thessaly, Greece, e-mail: leoloent@vet.uth.gr

Abstract. We assessed the benefits of vaccination against *Mycobacterium avium* subsp. *paratuberculosis* (MAP) on the average daily milk yield (DMY) of sheep and goat flocks. A stochastic simulation model was used to estimate the DMY pre and post vaccination of the flock replacements. The average DMY increased steadily for the first ten years post vaccination and then reached a plateau. Medians for the DMY were significantly higher post vaccination. The expected difference between the prevalence of MAP infection between and after the initiation of the vaccination program was the most influential factor for the DMY benefits. Vaccination of replacements in a MAP infected flock is expected to improve the overall milk productivity in the long term.

Keywords: Paratuberculosis, milk, vaccination, stochastic simulation.

1 Introduction

Paratuberculosis is a chronic intestinal infection of domestic and wild ruminants, which is caused by *Mycobacterium avium* subsp. *paratuberculosis* (MAP). As a result of the progressing MAP infection, infected animals develop reduced productivity, body weight, fertility and, ultimately, die or are prematurely culled. One of the main approaches to reduce the impact of paratuberculosis in sheep and goat flocks is through vaccination of the replacement stock in order to increase their resistance to infection. Vaccination of all sheep in an affected flock has been shown to provide effective disease control in Australia (Windsor, 2006) and underpins the national control program along with a risk-based trading system. Yet, the expected benefits of vaccination in dairy sheep and goats have not yet been quantified. Only scarce and conflicting reports about the direct benefit of vaccination on milk production exist in dairy cows (Juste et al., 2009). Hence, the objective of this study was to assess the expected benefits of vaccination on the milk productivity of dairy sheep and goats.

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2 Materials and Methods

A stochastic simulation model was used to assess the expected benefits on the average daily milk yield (DMY) from a vaccination of replacements program. The infection and milk production status of the 200 sheep and goat flock is simulated for 30 years. For the first ten years, the model assumes that vaccination does not take place, while vaccination of the flock replacements starts at the eleventh year and is simulated until the thirtieth year. The yearly assumed replacement rate, the infection rate and the expected average DMY for vaccinated and unvaccinated animals was derived from relevant published literature (Kostoulas et al., 2006; Liapi et al., 2012; Angelidou et al., 2014) and the expert opinion of two authors (EA and LL). Summary of the derived estimates and their corresponding distributions are in Table 1. The model assumes that animals who get infected remain infected for their productive life or until replaced.

Following the primary analysis, sensitivity analysis was performed to assess the impact of different infection rates and DMYs on the expected benefits of vaccination.

The DMY estimates were based on 200 simulations. The model was developed and ran in R. Codes are freely available from the first author upon request.

Table 1. Input parameters for the replacement rate (RR), infection rate (IR) and the average daily milk yield (DMY) for vaccinated and unvaccinated against *Mycobacterium avium* subsp. *paratuberculsosis* sheep and goats.

Input parameter	Parity	Estimate			Distribution
		Min	mode	Max	
RR	All	-	0.17	0.25	beta(17.4, 78.2)
IR unvaccinated	All	0.10	0.15	-	beta(14.5, 77.7)
IR vaccinated	All	-	0.002	0.01	beta(1, 458)
DMY healthy animals	1	0.7	1	1.2	triangular(0.7, 1, 1.2)
	2	0.8	1.3	1.5	triangular(0.8, 1.3, 1.5)
	3	0.8	1.35	1.65	triangular(0.8, 1.35, 1.65)
	>4	0.8	1.25	1.5	triangular(0.8, 1.25, 1.5)
Decrease (%) in DMY infected animals	1	-	5	10	beta(6, 99)
	2	-	10	15	beta(15, 130)
	3	-	15	20	beta(28, 153)
	>4	10	15	-	beta(14, 77)

3 Results

Estimates for the average DMY for a period of 30 years are in Figure 1. For the first ten years the flock did not follow a vaccination program and under endemic disease status the DMY remains fairly similar. Since the initialization of a vaccination of replacements program – year eleven and on – DMY steadily increases. Estimates of the median DMY ten years pre vaccination, the first ten years post

vaccination and the last ten years of the vaccination program reveal a significant increase (Figure 2).

Sensitivity analysis revealed that the most influential parameter on the benefits of vaccination was the assumed infection rate in the cohort of vaccinated animals with decreased rates leading to higher and earlier DMY benefits.

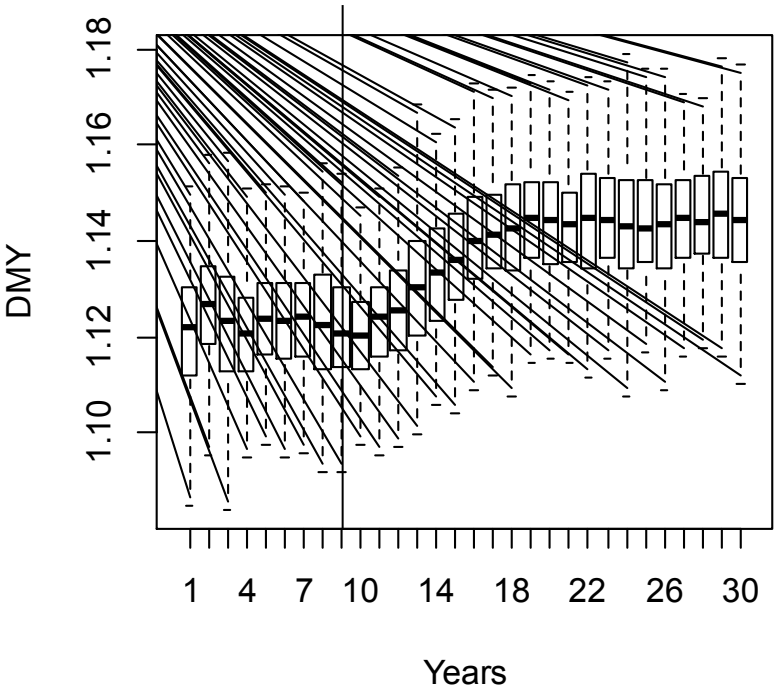

Fig. 1. Predicted average daily milk yield (DMY) in kg before and after commencement of the vaccination of replacements against Mycobacterium avium subsp. paratuberculosis (MAP) in a 200 sheep and goat flock. The vertical line at year 10 marks the initiation of vaccination. Boxes represent inter-quartile ranges and the solid black line at the approximate center of each box is the median; the arms of each box extend to cover the central 95% of the DMY distribution with their ends corresponding to 2.5^{th} and 97.5^{th} percentile.

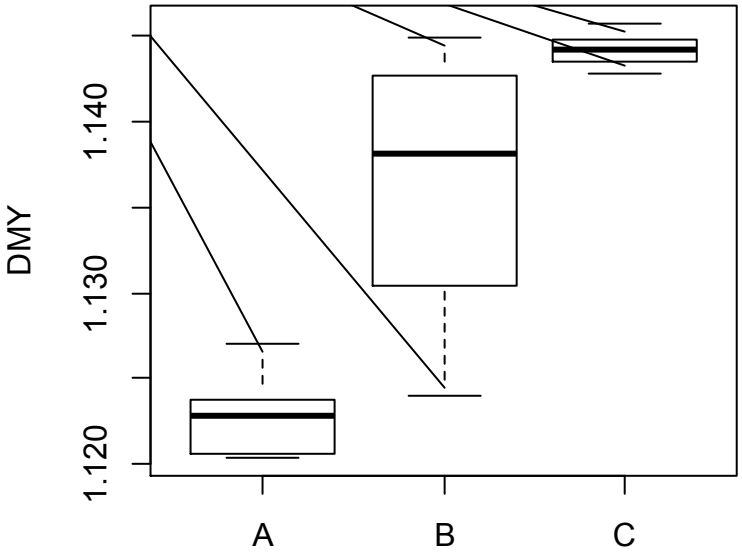

Fig. 2. Predicted median of the DMY ten years pre vaccination against MAP (A), ten years post vaccination (B) and ten to twenty years post vaccination (C).

4 Discussion

In this study we explored the potential benefits of a vaccination of replacements program on the average DMY of dairy sheep and goats. Despite the fact that an overlap was observed between the yearly DMY estimates this was mostly due to the full stochastic approach rather than the absence of actual benefits on the DMY of vaccinated animals. The benefits of vaccination have been masked under the calculation of the average DMY for the whole herd, rather than the calculation of separate DMYs for the vaccinated and unvaccinated animals. Hence, in a flock with 15% true prevalence of MAP infection an average improvement of approximately 12% in the DMY for the vaccinated cohort corresponds to a much lower benefit for the average DMY of the flock. Clearly, the overall DMY gains further decrease in herds/flock with lower prevalence of MAP infection. The latter could also explain the conflicting reports on the direct benefits of vaccination in the milk production of dairy cows (Juste et al., 2009). Still, as indicated by the calculation of median DMYs

pre and post vaccination, the long-term benefits from vaccinating the replacement stock are unquestionable.

MAP vaccination constitutes one of the main approaches to reduce the impact of paratuberculosis in sheep and goat flocks. MAP vaccination though not directly preventing from infection, it reduces the occurrence of clinical cases of MAP and MAP excretion from infected animals, thus, cutting off routes to new infections and minimizing MAP-associated direct and indirect production losses (Windsor, 2006). Our model is a first attempt to quantify the positive effect of MAP vaccination on the milk productivity of dairy sheep and goats. Currently ongoing studies that aim to measure the actual benefit in the DMY for vaccinated animals will provide additional real life data and refine our estimates on the improvement of the milk productivity of dairy sheep and goats.

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An Image Processing Based Approach for Detection of Nitrogen Status in Winter Wheat Under Mild Drought Stress

Hamed Tavakoli[1], Seyed Saeid Mohtasebi[2], Robin Gebbers[3]

[1]Department of Mechanical Engineering of Biosystems, Faculty of Agriculture, Arak University, Arak 38156-88349, Iran, e-mail: htavakoli1985@gmail.com
[2]Department of Agricultural Machinery Engineering, Faculty of Agricultural Engineering & Technology, University of Tehran, P.O. Box 4111, Karaj 31587-77871, Iran
[3]Leibniz-Institute for Agricultural Engineering, Max-Eyth-Allee 100, 14469 Potsdam, Germany

Abstract. Nitrogen is one of the most important agricultural inputs affecting crop growth, yield and quality in rain-fed cereal production. In this study an image processing based approach was used for detection of nitrogen status in winter wheat. Four N fertilization rates (0, 60, 120 and 240 kg N ha^{-1}, in total) and two water regimes (irrigated and non-irrigated) were applied to winter wheat. Digital images of the plant canopy were acquired using a Canon camera during the growing season 2012. Different indices were extracted by processing of the images. According to the statistical analyses, all the indices were affected by both N and water supplies. However, Rm, RMB, NRMB, Hue and INT were less sensitive to water supply. Among the indices, crop coverage (CC) showed better results for detection of nitrogen status of the plant. We conclude that digital cameras can be used to assess nitrogen status of winter wheat.

Keywords: Precision agriculture, nitrogen, drought stress, wheat, digital camera.

1 Introduction

Nitrogen (N) is one of the most important agricultural inputs affecting crop growth, yield and quality in rain-fed cereal production. A mismatch between N supply and crop requirement can potentially hamper crop growth or harm the environment, resulting in poor N use efficiency (NUE) and economic losses (Tremblay et al., 2009). Thus, considerable efforts have been done to develop crop sensors that provide instant information as a basis for decision making on nitrogen fertilization. Examples are: Spectral-optical spot-sensors: like Yara N-Sensor (Tremblay et al., 2009), Acoustic sensors (Sui and Thomasson, 2006), Chlorophyll fluorescence sensors (Limbrunner and Maidl, 2007), Laser distance sensors (Ehlert et al., 2008), and Cameras (Lee and Lee, 2013).

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Since digital cameras precisely record the appearance of photographic subjects in a non-destructive manner, they can be considered as proximal sensing devices to provide an alternative and inexpensive method for characterizing crop stand parameters (Sakamoto et al., 2012). There have been some efforts to use digital cameras for estimation of nitrogen status in wheat (Li et al., 2010), corn (Rorie et al., 2011), and rice (Lee and Lee, 2013).

The basic assumption in using the crop sensors for nitrogen fertilization is that nitrogen of a crop has the strongest effect on the crop attributes assessed by the respective sensor. However, there is an evidence that these crop attributes can be affected by other environmental factors such as water supply (Clay et al., 2006).

By reviewing the literature, information about effect of drought stress on the measurements of nitrogen status using digital cameras was not found. Therefore, the objective of this study was to investigate the possibility of using a RGB camera for assessing nitrogen and water supply in winter wheat.

2 Material and Methods

During the 2012 growing season, a field experiment was conducted at the Bundessortenamt Marquardt experimental station, Potsdam, Germany (52°27' N, 12°57' E). The experiment was designed as a randomized split block design with two replications. Treatments on winter wheat (cv. Cubus) consisted of four N fertilization rates (0, 60, 120 and 240 kg N ha^{-1}, in total) and two water regimes (irrigated (Irr) and non-irrigated (NIrr)). During the growing season, the non-irrigated plots received 272 mm of precipitation, while the irrigated plots received an additional 20 mm of irrigation on two dates (18 April and 29 May).

Soil moisture was assessed by TDR soil moisture probes (ECH2O, Decagon Devices, Inc., Pullman, WA, USA). The sensors were positioned at a depth of 15 cm in irrigated and non-irrigated soils.

Above ground biomass sampling was performed three times (at weeks 19, 21 and 23 of the year 2012). The fresh biomass was put into plastic bags, immediately weighed, and then oven dried at 75 ºC for 24 h. The shoot fresh biomass (FB) and the shoot dry biomass (DB) (g m^{-2}) were recorded. The plant samples were chopped and the N content (% dry weight) was measured by the standard Kjeldahl method in laboratory. Crop yield and final biomass were also recorded during the harvesting time.

Digital images of winter wheat canopy were acquired by a Canon camera model EOS 550D with a resolution of 18.0 megapixels. Medium resolution of the camera was used. The resulting images had a size of 3456 × 2304 pixels at Program AE shooting mode of the camera. The camera was set to automatically adjustment f-stop and shutter speed, however, focus was set manually. The colour images were recorded in JPEG format and downloaded to a desktop computer for subsequent processing.

The images were taken looking vertically downward from a height of 1.8 m, which resulted in a rectangular area of 1.5 × 1.0 m on the ground. The photos were

recorded at different plant growth stages including: stem elongation, booting stage, Inflorescence emergence, heading, flowering, and development of fruit.

To extract crop coverage and colour indices from the digital images, image processing was performed using MATLAB software (Version 7.13, R2011b, Mathworks Company). For segmentation of the green plant against background, a by a mask (M) (binary image) was derived from the difference between green (G) and the red (R) band of each image together with the threshold t:

$$M = \begin{cases} 1 & for \quad (G-R) \geq t \\ 0 & for \quad (G-R) < t \end{cases} \tag{1}$$

Crop coverage (CC) was defined as the proportion of plant pixels in an image:

$$CC = \frac{\sum M}{n \cdot m} \tag{2}$$

where n and m are number of rows and columns of pixels.

Various colour indices were obtained from plant part of the images defined by the mask M:

$Rm = R*M$; $Gm = G*M$; $Bm = B*M$; $GMR = Gm - Rm$; $GMB = Gm - Bm$; $RMB = Rm - Bm$; $NGMR = (Gm - Rm)/(Gm + Rm)$; $NGMB = (Gm - Bm)/(Gm + Bm)$; $NRMB = (Rm - Bm)/(Rm + Bm)$.

where R, G and B are the intensity levels of the red, green and blue channels, respectively. The values were then averaged for each image.

Hue, Saturation (SAT) and Intensity (INT) were also calculated according to Tang et al. (2003):

$$\text{Hue} = \begin{cases} \theta & if\ B \leq G \\ 360 - \theta & if\ B > G \end{cases} \tag{3}$$

$$\theta = \cos^{-1}\left\{ \frac{\frac{1}{2}[(R-G)+(R-B)]}{[(R-G)^2+(R-B)(G-B)]^{1/2}} \right\} \tag{4}$$

$$\text{SAT} = 1 - \frac{3}{(R+G+B)}[min(R,G,B)] \tag{5}$$

$$\text{INT} = \frac{1}{3}(R+G+B) \tag{6}$$

The data obtained from the measurements and the image processing were analyzed using analysis of variance (ANOVA) and the means were compared at 5% level of significance using the Tukey range test in SAS software (version 9.3, SAS Institute, Inc., Cary, N.C., USA). Regression and correlation analysis were done using MATLAB software (Version 7.13, R2011b, Mathworks Company).

2 Result and discussion

The statistical analysis results indicated that there were strong significant differences among the N supply levels and between the irrigation regimes in the case of crop yield and final straw of the crop (p<0.01). The differences of N supply levels for fresh and dry biomass and also plant N content were highly significant (p<0.01)

in all three times of biomass sampling. However, the differences of irrigation regimes for these crop properties were mostly insignificant (p>0.05).

According to the soil water retention curve for sand, a volumetric water content of 10% was considered as field capacity and about 3% as permanent wilting point (Ehlert, 1996). Results of soil water content showed that the lowest readings (around permanent wilting point) were observed between days 235 and 245 after sowing (weeks 22 and 23 of the year) for non-irrigated part of the trial field. During this period, leaf rolling was also observed in the plants of non-irrigated part. Therefore, in spite of having a relatively wet vegetation season for the year 2012 in northeast Germany, a mild drought stress was observed.

Statistical analyses of the data showed that the effect of nitrogen supply on all the colour indices (except Bm) was significant at 1 % level for all the growth stages considered. In addition, the analyses showed that among the indices, Rm, RMB, NRMB, Hue and INT were less sensitive to water supply.

Time course of the crop coverage (as an example of the colour indices) is shown in

Fig. **1**.

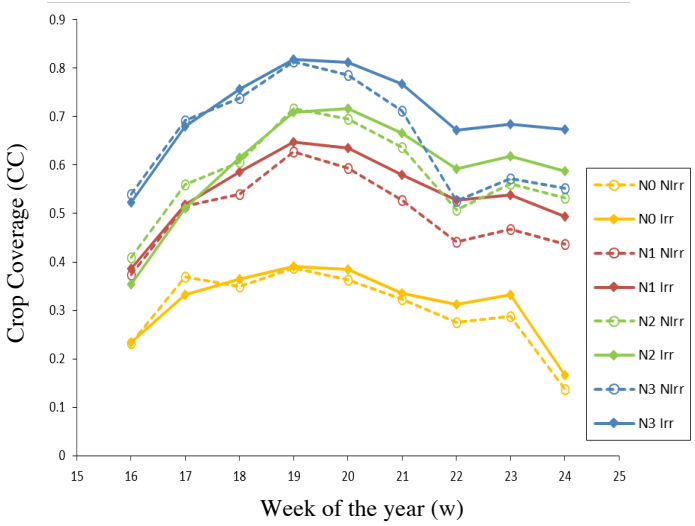

Fig. 1. Time course of crop coverage for irrigated (Irr) and non-irrigated (NIrr) wheat crops growing under 4 levels of nitrogen supply (N0=0, N1=60, N2=120, N3=240 kg N/ha)

According to the statistical analyses and time course of the colour indices, all the indices were affected by both N and water supplies. However, Rm, RMB, NRMB, Hue and INT were less sensitive to water supply. Li et al. (2010), Wang et al. (2013) and Lee and Lee (2013) showed that CC estimations obtained by digital cameras were good indicators for detection of nitrogen status in wheat and rice.

The three above studies did not consider effect of other plant stresses such as drought stress on the results. Based on the results obtained in the current study, the values of CC and other indices can be affected by drought stress. Therefore, in the

case of drought stress, these indices can become less reliable for site-specific N management.

The indices Rm, RMB and Hue were less affected by water supply and showed high differences among nitrogen supply levels. Thus, they have a potential to be good indicators for detection of nitrogen deficiency.

As it is seen in Table 1, CC, NGMR and Hue had a strong positive correlation, while Rm, Gm, GMB, RMB, NGMB, NRMB, SAT and INT had a high negative correlation with the direct measurements of the agronomy parameters at all three times of sampling. Bm and GMR had a weak correlation with these parameters.

Among the colour indices, the strongest correlations with N content, FB and DB were obtained for Rm (rho=-0.926), Rm, GMB and RMB (rho=-0.953), and GMB and RMB (rho=-0.956), respectively (Table 1).

Table 1. Spearman's rho for correlation of direct and indirect measurements of winter wheat

variable	10.05.2012			25.05.2012			08.06.2012		
	N content (%)	FB (g m^{-2})	DB (g m^{-2})	N content (%)	FB (g m^{-2})	DB (g m^{-2})	N content (%)	FB (g m^{-2})	DB (g m^{-2})
N content	1	0.915^{**}	0.897^{**}	1	0.594^{*}	0.591^{*}	–	–	–
FB	0.915^{**}	1	0.994^{**}	0.594^{*}	1	0.979^{**}	–	1	0.994^{**}
DB	0.897^{**}	0.994^{**}	1	0.591^{*}	0.979^{**}	1	–	0.994^{**}	1
Height	0.918^{**}	0.950^{**}	0.930^{**}	0.575^{*}	0.905^{**}	0.936^{**}	–	0.885^{**}	0.872^{**}
CC	0.912^{**}	0.944^{**}	0.938^{**}	0.815^{**}	0.891^{**}	0.876^{**}	–	0.915^{**}	0.929^{**}
Rm	-0.926^{**}	-0.953^{**}	-0.950^{**}	-0.826^{**}	-0.885^{**}	-0.868^{**}	–	-0.851^{**}	-0.853^{**}
Gm	-0.918^{**}	-0.935^{**}	-0.935^{**}	-0.841^{**}	-0.897^{**}	-0.882^{**}	–	-0.828^{**}	-0.829^{**}
Bm	-0.468^{ns}	-0.529^{*}	-0.515^{*}	0.144^{ns}	-0.026^{ns}	-0.029^{ns}	–	0.328^{ns}	0.312^{ns}
GMR	0.253^{ns}	0.209^{ns}	0.215^{ns}	0.315^{ns}	0.326^{ns}	0.312^{ns}	–	0.679^{**}	0.674^{**}
GMB	-0.885^{**}	-0.953^{**}	-0.956^{**}	-0.812^{**}	-0.868^{**}	-0.871^{**}	–	-0.835^{**}	-0.824^{**}
RMB	-0.885^{**}	-0.953^{**}	-0.956^{**}	-0.791^{**}	-0.891^{**}	-0.897^{**}	–	-0.859^{**}	-0.847^{**}
NGMR	0.915^{**}	0.935^{**}	0.924^{**}	0.844^{**}	0.862^{**}	0.832^{**}	–	0.862^{**}	0.876^{**}
NGMB	-0.853^{**}	-0.909^{**}	-0.918^{**}	-0.812^{**}	-0.812^{**}	-0.821^{**}	–	-0.791^{**}	-0.779^{**}
NRMB	-0.871^{**}	0.935^{**}	-0.935^{**}	-0.809^{**}	-0.862^{**}	-0.868^{**}	–	-0.797^{**}	-0.791^{**}
Hue	0.871^{**}	0.935^{**}	0.935^{**}	0.797^{**}	0.894^{**}	0.906^{**}	–	0.850^{**}	0.844^{**}
SAT	-0.865^{**}	0.929^{**}	-0.932^{**}	-0.818^{**}	-0.859^{**}	-0.862^{**}	–	-0.800^{**}	-0.794^{**}
INT	-0.894^{**}	-0.935^{**}	-0.932^{**}	-0.824^{**}	-0.879^{**}	-0.859^{**}	–	-0.700^{**}	-0.712^{**}

^{ns}: No significant difference; **: Significant at the 0.01 level; *: Significant at the 0.05 level; –: Data not available

The colour indices were used to develop regression models for predicting plant fresh and dry biomasses, and also N content.

Performance of the indices for predicting the plant parameters were near to each other as demonstrated by the r^2 and RSME of the equations. However, for predicting N content, the index CC (r^2=0.94) presented the best relation (exponential). The Rm showed the weakest quality among the indices to relate the three plant parameters.

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A Novel Fully Automated Soil Erosion Monitoring System

Ioannis Kosmadakis[1], Panagiotis Tsardaklis[2], Konstantinos Ioannou[3], and George N. Zaimes[4]

[1]Electronics Laboratory, Department of Physics, Aristotle University of Thessaloniki, Greece, e-mail: ikosm@physics.auth.gr
[2]Electronics Laboratory, Department of Physics, Aristotle University of Thessaloniki, Greece, e-mail: ptsardak@gmail.com
[3]Dept. of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology, Drama, Greece, e-mail: ioannou.konstantinos@gmail.com
[4]Dept. of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology, Drama, Greece, e-mail: zaimesgeorge@gmail.com

Abstract. Soil erosion is one of the biggest global environmental problems. Finding new innovative systems to measure soil erosion more accurately is a priority. An effort is being carried out in this study to use automated electronics in order to systematically and accurately measure soil erosion. In addition, the frequent measurements taken will help collect a large amount of data on soil erosion. The design of an autonomous, fully automated and remotely controlled soil erosion monitoring system is presented in this work. A novel approach that uses ultrasounds to detect ground level changes with very good accuracy (less than 1mm), is proposed. The presented setup is capable of monitoring other import parameters related to soil erosion, such as soil moisture, soil temperature and rainfall. The collected data will be used to further understand soil erosion processes that will help land managers mitigate this problem effectively and efficiently.

Keywords: Soil erosion monitoring, Ultrasound signals, Soil erosion processes, Remote sensing.

1 Introduction

Today soil erosion is considered one the most serious environmental problems in the world despite being a natural geomorphologic phenomenon (Yang et al, 2003). Soil erosion has accelerated because of the unsustainable anthropogenic activities, especially since the beginning of the 19th century (Bakker et al, 2008). The anthropogenic activities have resulted in substantial changes of the natural vegetation cover, primarily in agricultural and urban land covers. Typically, these land-uses have excessive soil erosion levels that exceed soil formation levels (soil forms slowly).

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The Mediterranean is a region extremely prone to erosion. The main reason being that humans have inhabited it for thousands of years (Kosmas et al, 2002). In addition, the semi-arid and arid environments limit vegetation growth and cover, leaving large tracts of land that have long dry periods vulnerable to intensive erosive rainfall that lead to considerable erosion rates (Zaimes et al, 2012a; Zaimes et al, 2012b). In Greece, it has been reported that 26.5% of the country's total land area have serious problems of soil erosion (Mallios et al, 2009).

The Mediterranean region is also susceptible to climate change impacts. The IPCC forecasts, predict precipitation intensification and drought periods prolongation. These conditions will lead to higher and more surface runoff that will also increase sediment transport capacity. As a result one of the major threats that will continue and will increase in the Mediterranean region is soil erosion (Giupponi and Shechter, 2003).

The objective of this study was the developement of a sensor that measures erosion very accurately at a specific location. This new tool will use ultrasound signals while also measuring other important factors that are correlated to soil erosion. These measurements by the sensor will allow in the better understanding and comprehension of soil erosion processes, while providing scientifically sound data to the decision makers and the general public on the potential soil erosion problems of the region.

2 Erosion System Overview

The main focus of this work is the design and composition of a fully automated and autonomous system that is able to monitor and store important environmental quantities, useful for study of soil erosion study. The block diagram of the proposed experimental setup is presented in Fig. 1. It can be divided into three major blocks: i) power supply, ii) measurement and logging units and iii) communication unit.

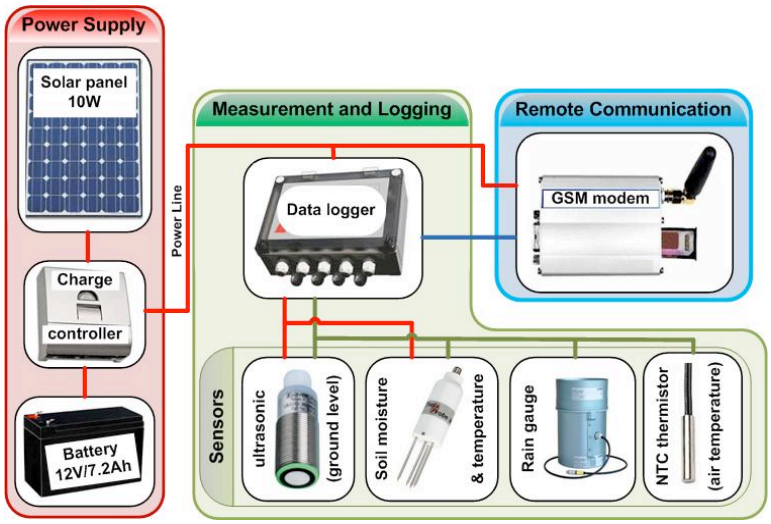

Fig. 1. Block diagram of the proposed Automated Soil Erosion Monitoring System.

Solar radiation was chosen to ensure the energy independency of the system, since it is the most well known, reliable and virtually maintenance-free renewable source. All the electronics included in the station are powered by a small Pb battery (12V/7.2Ah).

The automation of measurement procedure and data storage is performed by the data logging module. It is a low power/high accuracy, special purpose data logger, equipped with a secure non-volatile flash memory. Its memory capacity (>500000 readings) is sufficient enough to store data for over 10 years of continuous recording, for the selected measurement time interval (1 hour).

Another important feature of the proposed system, regarding the logging frequency, is that it provides dual rate recording (aka accelerated logging). The data logger is able to change (shorten) the measurement time interval for specific quantities (e.g. soil moisture, soil erosion), when triggered by a predefined parameter (e.g. rainfall).

The quantities that can be monitored, as shown in Fig. 1, are: i) soil erosion/deposition (ground level changes), ii) soil moisture, iii) soil temperature, iv) rainfall and v) air temperature. More information about the sensors used is given in the section that follows.

Remote communication with the station is achieved through GSM network. It is a simple, secure and consistent solution that sets no limits to the positioning of the station, since it can be placed wherever there is mobile network coverage.

3 Measured Quantities

As mentioned above, some of the quantities that need to be measured to study soil erosion are: a) ground level changes, b) soil moisture, c) soil temperature and d) rainfall.

A novel approach is proposed to measure ground level changes using ultrasounds. Soil erosion/deposition is detected using a diffuse mode ultrasonic sensor. The sensor emits ultrasonic pulses and receives the reflected ones. The distance from the sensor to the reflector (ground) is determined by measuring the propagation time. Using this approach, an accuracy of less than 1mm can be achieved.

Soil moisture is measured using electromagnetic waves. When the sensor is powered, it creates an electromagnetic wave (similar to FM radio), that is applied into the soil. The sensor is able to detect the influence of soil permittivity to the applied field, resulting in a sufficient measure of soil moisture content (1% vol accuracy).

A modern double tipping bucket rain gauge (aka udometer) with an orifice of $200cm^2$, is used to record rainfall. A pulse is generated at each tipping action that equals to 0.2mm rainfall. The output of this sensor is used as a trigger signal to enable the previously described accelerated logging.

Finally soil and air temperatures are measured by two different 10KOhm NTC thermistors.

Conclusions

A novel fully automated soil erosion monitoring system is introduced. The proposed system is energy independent, has very low (almost none) maintenance needs and uses an innovative approach to detect soil erosion through ultrasounds. A demo station has already been assembled in the laboratory and is ready to be placed in the field. Measurement results will be available in the very near future.

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Development of Software for the Farms Accounting

Dimosthenis Mpoutakidis[1], Alexandra Pavloudi[2], Stamatis Aggelopoulos[3], Maria Rapti[4]

[1]Department of Agriculture Technology, Direction of Agricultural Economy, Alexander Technology Educational Institute of Thessaloniki, Greece, e-mail: dboutak@farm.teithe.gr
[2]Department of Agriculture Technology, Direction of Agricultural Economy, Alexander Technology Educational Institute of Thessaloniki, Greece, e-mail: stalex@farm.teithe.gr
[3]Department of Agriculture Technology, Direction of Agricultural Economy, Alexander Technology Educational Institute of Thessaloniki, Greece, e-mail: stamagg@farm.teithe.gr
[4]Department of Agriculture Technology, Direction of Agricultural Economy, Alexander Technology Educational Institute of Thessaloniki, Greece, e-mail: ma_rpt@yahoo.gr

Abstract. This is an application, which contributes to the improvement of the economy in a farm through the systematic recording and organization of economic and technical data. Initially, given some useful general information on a theoretical level, which relate to the way in which agricultural enterprises are organized. Then, there is the way in which was created “Agrologic”, such as the setting up of the tables and the creation of the template. Here's a guide for the application, allowing the user to be able to enter the details of the agricultural enterprise and to manage them. The "Agrologic" is a user friendly application, which can be used by everyone, without a special financial or accounting knowledge. It aims to help farmer in a position to manage the economics of the agricultural unit, because the application can produce the overall results automatically, without the need to calculate.

Keywords: Agricultural accounts, Application, Agrologic

1 Introduction

The competitive environment within which agricultural activity is developed makes necessary the modernization of agricultural holdings and the adoption of new technologies to improve effectiveness and productivity. Farmers are being urged by their advisors to use accounting as a means of survival in an industry dominated by corporations yet find their calculations and plans nullified as corporations raise the costs of their inputs and lower the prices obtainable for their outputs. (Jack, 2007)

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2 Conceptual Description Conditions

2.1 Agricultural Accounting

There are very few studies on the subject of agricultural accounting. The field of academic agricultural management research lacks both qualitative empirical studies and sociological interpretations (Argiles & Slof, 2001 and Juchau & Hill, 2000), whilst the agriculture and food industries are largely absent from studies in management and accounting generally (Argiles & Slof, 2001).

Accounting for spatial heterogeneity is, however, a key step in the integrated assessment of agricultural production systems (Antle and Stoorvogel, 2006 and Antle et al., 2006).

Inventory:

Keeping inventory is the process by which the producer categorizes the assets of a holding, the counting and the records in physical units and economic value. The inventory shall be drawn up at the beginning and at the end of each financial year and the balance sheet of the agricultural holding (Kitsopanidis, 1993).

Ways of agricultural accounting

According to Kitsopanidis, (1993), there are three ways to keep the accounting of farm: Monitoring the accounts of the farm as a whole, Accounting farm per categories of like industries and Accounting farm per industries.

In the light of the rational organization of agricultural holdings, which the farmer uses the limited resources factors of production in industries which contribute most to improving the income of the accounting is essential.

The use of electronic computers in agriculture

The computers are used in agriculture to resolve problems of rural economy, because it helps in quick decision-making. Given the substantial growth in computer hardware and software functionality, it would be helpful the agricultural software vendors, farm consultants, state and federal agricultural agencies, agribusinesses to determine what computer technology producers now own and how they use it. (Flanagan, 1995).

Software applications frequently mentioned in computer use studies about financial administration, taxes, accounting, business planning, budgeting, livestock management, crop management, and market analysis or decision making. (Ascough et al, 1999)

Use of computers makes it possible to process large amounts of data order to try out new methods of mathematical Programming, simulation, the econometric models, advanced methods of forecasting etc. (Manos, 1995).

The use of computers in Greek agriculture has helped considerably to measure and check the various figured to increase the productivity and services available to factors of production, to exert effective agricultural policy and to provide new growth. (Grammatikou, 2008).

2.2 Objectives and Characteristics of "Agrologic"

In particular, the application "Agrologic" intends to help farmers and producers, to record and edit quickly and easily the economics of their farms. The application "Agrologic" gives the possibility even for non-specialists to use it.

"Agrologic" is a software application that is addressed to the modern farmer for the management of agricultural holdings. With this software the farmer/grower has the capability to store all the data of agricultural holding, keeping full calendar of all cultivation of work, comply with the department of supplies, keep budget and monitoring of the progress of implementation, detailed monitoring the cost of each crop at the working level and individual rates and a full picture of the economic effect of the holding, recording and storing information, helping to keep the configuration integrated in the management.

Based on data from previous periods you will be in able to decide on the crops and to make specific estimates of production, price and cost. The aim is to protect yourself and the production from residues of substances through the warnings for permissible times and re-harvest. Observing the traceability in terms of batches and harvest, you will be able to have easier access to markets that require tracking (Aiello et al 2015).

Stages of implementation and connections

Below are the stages of the application "Agrologic".

Initially, it was an empty database with the application Access 2007 Microsoft, called "Agrologic".

On this basis were three electronic books accounting, the book Accounting farms as a whole, the book Accounting Floral Park Farm as a whole, and the paper Accounting Agricultural Holdings - greenhouses (Martica-Bakirtzi & Dimitriadou, 2007).

Having designed all the forms for each workshop, placed in groups.

The basic books are:

Manual monitoring' accounting system rural operating as single total
Manual of accounting of a greenhouse holding (vegetables) and
Manual monitoring' accounting system of a floral farm operating as single total

The groups who belong in every book are separated:

A. Composition of the farm and family
B. Inventory and assessment of the value of assets of the holding
C. Data Processing of holding

The books are differentiated in groups of Single account of production plan. Each group separated in the book in subgroups: Production planning, composition of the farm and family, Experience and the training of the leader or the members of the family, Work available for the family and permanent workers (hours/ month), Inventory and assessment of the value of assets of the holding, field, areas in improvements, equipment of buildings and constructions, census perennials lands (vegetables section), machinery and tools, logs referred to in forms fixed and variable capital, Calculation deprecation permanent capital and annual expenditure, Capital structure of the holding, Financial results.

Finally, according to the book the groups include the subgroups Single account of production plan (calendar physical or technical and economic data), Account tractor:

tractor type, horsepower, age, technical specifications, Requirements of project production in hours of human or/and mechanical work per month and per acre, Inventory machinery and tools, Inventory ground, Inventory areas improvements, Inventory agricultural construction, Inventory machinery, Inventory loans referred to in forms fixed and variable capital, Calculation depreciation permanent capital, Calculation annual expenditure, Capital structure of the holding, Technical and financial data per unit production sectors Account industry: calendar physical or technical and economic data of the industry, calendar harvest, account means of transport: type means of transport, power, age, technical specifications, General payments and receipts of the holding, Technical and financial data per unit production sectors, Requirements of industries in working hours per month: human labor, mechanical work, Variable cost industries, Gross annuity industries, Gross profit industries, Productive expenditure of exploitation and participation of the entire coefficient, Financial results

THE APPLICATION "AGROLOGIC": Application Guide

Description of the implementation: platform development and implementation; tools, application requirements in hardware etc.

Start the application "Agrologic", which was created and designed exclusively for a specific task. With the opening of the application, the first image that the user sees is figure (1).

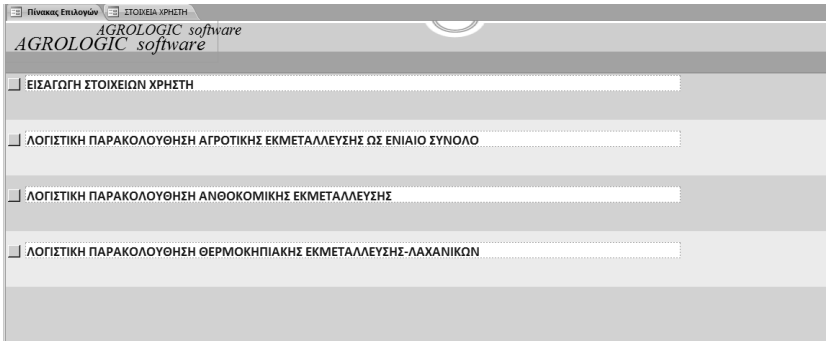

Fig 1. Start the application "Agrologic"

In the beginning, the user has the option to choose the group, in which he wants to enter the data. Initially, it will be necessary to start with group A, for the recording of the composition of the holding of the user-producer and then to continue with the other groups.

Selecting the first form the user automatically enters into the PROJECT production form.

The following (figure2) shows the introduction of three random entries, as an example for the user.

Fig. 2 Example recordings

In the industry the user can choose the exploitation that he is interested in. The field AREA enters the number of acres which grows and the system automatically determines the area in percentage (%) that uses for the farm in relation to the total acres of production. The green fields in all forms that are displayed automatically by the system the fields shown here, as can be seen in this form (figure 2), are set by the system.

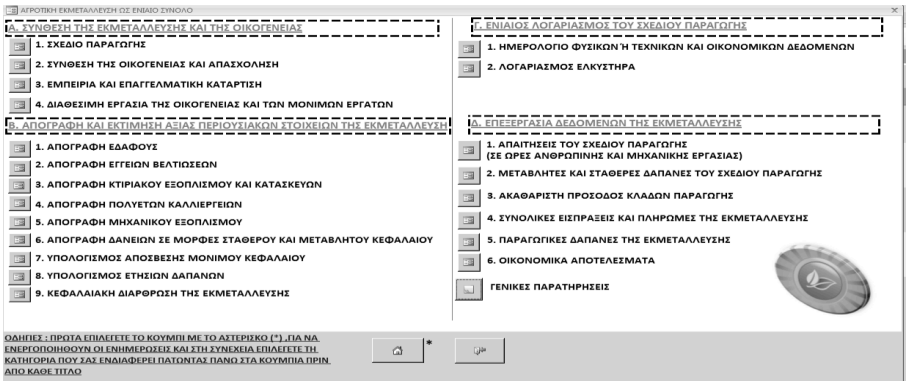

Fig. 3 Select accounting

Initially a list is presented with options prompts for the user to enter the first data when required to supplement the name, the access name (username) and password (password), given to him by the designer of the application. Then the user selects the accounting category wishing to introduce the data as exploitation as a whole, floricultural exploitation and greenhouse vegetable exploitation.

The user of the application has the ability to control the total number of records entered, to move from the first record to the next (and vice versa) and of course, to introduce a new recording, with the corresponding button located on the status bar.

Furthermore, on the right side of the template there are three command buttons. The first button prints, the lower section of the template (the secondary form), with the total records, to allow the user of the application to print a form with the aggregated data of the holding. The second button closes the current form and inform for the storage of data. The third button refreshes the entire form so as to make the overall results appear more quickly.

Another possible application is to filter the data in the form and be able to display the records with specific criteria (Figure 4).

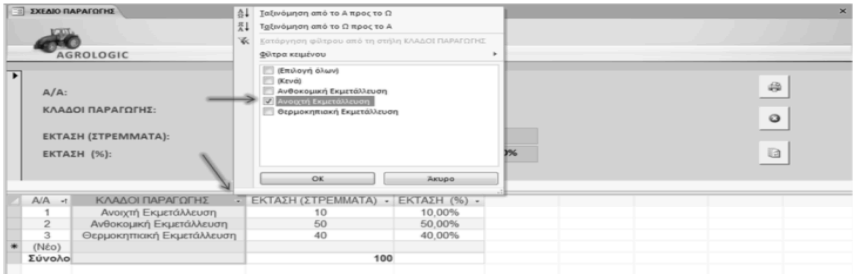

Fig. 4. Filtering data search

3 Summary and Conclusions

The characteristics of the application "Agrologic", as presented above, are simple and intend to be easily accessible to the farmer, who has no accounting knowledge. The tables and the forms are distinct and include everything the non-specialist user, will need in order to organize an agricultural enterprise.

An application such as "Agrologic" will relieve the farmer of the unnecessary and complex calculations which require monitoring of the company accounts

Through the application "Agrologic", the farmer is able to record all the data for a farm, to keep full calendar of cultivation work, to monitor his available saved stores, to draw up a budget and to monitor the progress and the cost of each crop, to record and store information, so as to comply with the requirements of an integrated company. The weakness of this is mainly related to the ongoing development of the technology. In other words, as the applications and computers constantly evolve in the future we will have likely upgrade "Agrologic" and to put on a new footing some economic data. However, the basic structure and the simple logic are in position to help a farmer keep control of his business, not only by managing the already existing financial data, but also by improving the productivity of his business in the future. In fact, having all the data in portable or fixed, the computer can remember all your work and other obligations, without learning out something.

With "Agrologic" you cash daily monitor the stocks and know exactly what is needed, verify the costs for the salaries and wages of the workers, record the work and inputs, have better communication with the Agronomist, in order to get the correct advice and to make correct estimates for the future of farming.

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Session 1: ICT for AgroEnvironment & Development

Recent ICT Advances Applied to Smart e-Government Systems in Life Sciences

Alexander B. Sideridis[1], Loucas Protopappas[2]

[1]Informatics Laboratory, Agricultural University of Athens, Greece, e-mail: as@aua.gr
[2]Informatics Laboratory, Agricultural University of Athens, Greece, e-mail: loucas.protopappas@aua.gr

Abstract. As Internet of Things and Cloud Computing are gaining momentum, smart e-government systems and applications to citizens and business, adopting these technologies, improve further our everyday lives and business frontiers. E-government systems are further expanding their range of application also, by reclaiming advances in electronic authentication and identification. These late developments make even possible the application of smart e-government systems not only to the areas of immense security like Public Health and Banking but also to Life Sciences mainly Agriculture, Food Sciences, Farming, Forestry and the Environmental Sciences. In this paper an attempt is made to describe the framework of designing smart e-government applications aiming to support advanced with no national frontier limitations systems on the above important application areas. The importance of these systems is becoming greater taking into account that the economic recession hits particularly countries with main income from exports of agricultural products.

Keywords: Internet of Things, Cloud Computing, Radio frequency identification (RFID), Smart e-Government Agricultural Applications.

1 Introduction

A couple of years ago we had observed the potentiality of new forms of e-Government applications as well as the necessity of adopting advanced e-Government services in both enhancing citizen's daily activities and creating the appropriate basis in public administrations for the development of knowledge based economies [17][13]. Emphasis was given to the need of fully exploiting Information and Communication technologies (ICT) and new forms of communication for the development of the appropriate structures aiming to support complex e-Government systems which should extend further their area of application beyond national boarders and economies [5]. This need is immense since globalization has strongly emerged and we now discussion about global economies, global health, global banking systems etc. [10] Global security, in all those systems of international cooperation and application, is the dominant aspect and as recession, downturn in the

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economy and international terrorism remain the main areas of exchange of information and methodologies between international organizations, governments and individuals, this aspect promotes continuous research in this area.

The implementation of secure, trustworthy and smart e-Government systems in order to support common standardized procedures within a country has been encouraged by national governments and federal agencies [6]. In particular, the progress of standardization and unification within the European Communities at the beginning and European Union (EU) soon after has pressed State agencies for the transformation of already developed procedures to cross-border e-Government applications [7]. The EU policy towards convergence of e-Government systems of member States was expressed through a series of incentive programs promoting interoperability of those systems by introducing new research developments on e-Signature (e-SIGN), e-Authentication and e-identification (European Commission, [8],[9]). The latest EU's initiatives were aiming to create an integrated and well established workplace for e-IDentification and AUthentication, [(eID) and (eAU)] respectively, within European States for both citizens and enterprises or legal entities of any form. Since the EU project STORK 2.0 [19] has just been successfully implemented, these recent developments and EU's directives are going to be gradually adopted by security sensitive systems on e-banking, e-health, e-Justice and customs export systems of the member States [15]. However, if not, the above systems could not be put in practice efficiently and the envisaged creation of a Digital Single Market in Europe could not be materialized.

The operation of interoperable eID environments was one of the key objectives of STORK 2. In fact, this objective was successfully tested by the operation of four cross-sectoral pilots [15]. This implies that e-Government systems making use of this capability can be designed not only to the benefit of important Government to Government (G2G) or Government to Citizen (G2C) systems, such as those of public administrations, public health, education etc but also Government to Business (G2B) or Business to Business (B2B). The latest G2B and B2B will operate mostly to the benefit of private sector and are considered to be very vital for boosting Small to Medium Enterprises (SMEs), particularly these days of economic recession during which SMEs have badly hit, and the creation of new jobs is the main scope of nearly all Governments in order to fight unemployment. Particularly, countries of south Europe have experienced very high figures of unemployment, mainly in young people, e.g. in Greece this figure exceeds 50%, so that expected benefit out of the growth of new SMEs, in a few remaining areas of the primary sector, like that of agricultural production, is also high. Unemployment in Europe has brought many young people abroad looking for jobs and new opportunities. Thus, G2C systems with cross-border capabilities are invalid for safe certification using eID.

It's evident, up to now that federal strategies and policies, like those of the EU and the USA, towards the development of smart e-Government systems with capabilities as those described above, are acting as incentives and lead research [6] in the area of security and practically to innovative techniques e.g. on eID (with the prerequisite of e-SIGN) and eAU.

In the near past, not long before the EU's initiatives [8, 9, 19], just the opposite happened. ICTs and technological innovations used to provoke the policy makers to fully exploit them in designing their e-Government systems and applications tailored

made to their needs. Today, innovations such as those referred for e.g. to Big Data, Internet of Things (IoT) and Cloud Computing (CC), combined with more recent results on e-SIGN, eID, eAU, are leading us to design really smart e-Government applications applicable to many G2G and G2C applications, mainly in the area of our core interest in Agriculture, Forestry, the Environment and Food Technologies. Precisely, this is the focal of this paper and our ideas in designing such systems are analytically presented in section 5. For the completeness of these article innovations as those of IoT, CC, eAU and eID are presented in sections 2, 3 and 4 respectively. Finally, in section 6, are drown certain conclusions mostly based on the applicability of the proposed smart e-Government applications of section 5.

2 Internet of Things and its Expansion

The Internet of Things (IoT) is the upcoming evolution of the Internet services available today. It is a network that is not composed of computers but also of interconnected objects. These items will contain embedded electronic systems and may be of various household appliances, transportation, telecommunication means, books, cars, even foods. In this vision, each object will use radio frequency identification systems (known as RFID), a kind of sensor, etc. IoT will be the culmination of the effort to integrate and automate services that provide embedded systems of all kinds. All these are some applications that will radically change the current way of life in the next decades.

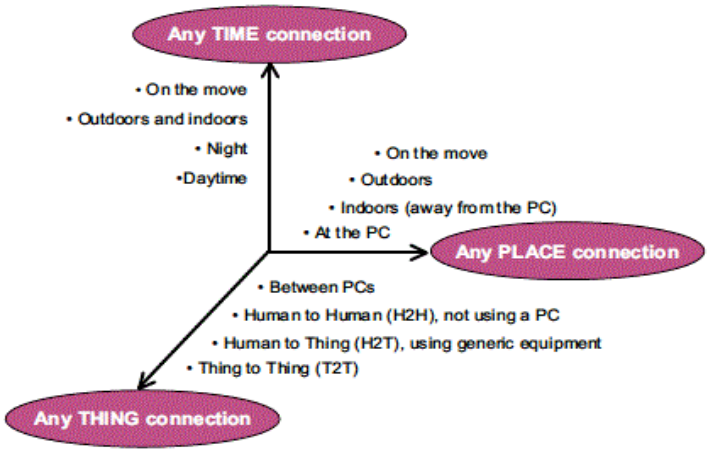

Fig. 1. A new dimension. Source: ITU adapted from Nomura Research Institute

Although, the sustainability of IoT is still being discussed, its usability seems to be very effective and efficient for citizen's daily activities as the connection of physical things to the Internet makes it possible to access management and operation of

remote devices [23]. Thanks to rapid advances in underlying ICT technologies, the IoT is opening enormous opportunities for many novel applications that citizens may improve the quality of their lives. International Telecommunications Union (ITU), in 2005, predicted that "the IoT will connect the world's objects both in a sensory and an intelligent manner", fact that, in our days, is verified. The technology of IoT, on the one hand, is a combination of 4 emerging promising technologies: RFID, Sensor technologies, Smart technologies and Nanotechnology and, on the other hand, it inherits the globality and interconnection of Internet and adds a new dimension to the world of ICTs: from anytime, any place connectivity for anyone, we will now have connectivity for anything (Figure 1).

The IoT has 3 major characteristics:

a. Integrated structure using RFID technology, sensors and two-dimensional code to collect information from objects anywhere and anytime.

b. Reliable transmission. Accurate and real-time information by the objects, involving various telecommunications networks and Internet.

c. Smart processing using smart ways such as cloud computing and fuzzy recognition (fuzzy identification) to analyze and process vast amounts of data and information, with a view to implementing intelligent control objects [25].

2.1 Architecture of Internet of Things and its Technologies

The IoT can be divided into three levels: the perception layer, the network layer and the application layer.

a. The perception layer consists of RFID tag and reader, camera, GPS, all kinds of sensors, sensor network, M2M terminals, and sensor gate (gateway), etc. The main function of perception layer is the perception and identification of objects and collecting information.

b. Network layer, also called as transport layer, is a convergent network that formed by all kinds of communication networks and the internet. The network layer has not only the ability of network operation, but should improve the ability of information operation. Also, it provides and processes information from the perception layers, like it is the nerve center and the brain structure, completing the transfer of information and data between perception layer and the application layer.

c. The application layer is mainly composed of types of application systems, with main functions the convergence, the transformation, the analysis and the exchange of data and the relevant support platform for users. Moreover, this layer also provides an interface for implementing IoT and the service's implementation for devices and user terminals.

The IoT is a technological revolution that represents the future of ICT and its development require support and collaboration with some innovative technologies. The major technologies that will dominate the IoT applications are wireless sensor networks (WSN), the radio frequency identification (RFID) and mobile communications with existing LAN / WAN networks.

2.1.1 Radio Frequency Identification (RFID)

The radio frequency identification is considered of the key drivers of growth of the IoT. The objects should be identified so that can be connected. RFID technology, which uses radio waves to determine the elements, can provide this function. The RFID system includes various frequency bands from 124 kHz as the 5.8 GHz, such as 124 kHz, 135 kHz, 13.56 MHz, 470 MHz, 900 MHz, 2.4 GHz and 5.8 GHz.

The technology composed of tags / transmitters, a reader and a computer support system. The tag has a unique identifier (ID) and an antenna for transmitting / receiving radio waves from the reader located nearby. The reader transmits the information that received from the tags in support system for validation and the backend system runs the applications, according to data received from the reader. Finally, RFID technology has been identified as the replacement of the bar code system, but the RFID system can do much more than that. In addition to the data identification, it can monitor the data in real time in order to get important information about their location and status.

2.1.2 Sensor Technologies

The sensors have the innovative ability to detect any change in the physical status of things and they provide a series of important data. In more details, the nodes collect and forward the data to the base station for the joint monitoring of physical objects or environmental conditions such as temperature, pressure and motion. In Wireless Sensor Networks (WSN) are usually one or more base stations and many sensor nodes. The base station acts as the trusted central authority and also serves as a data processor that connects the sensor network to the outside world.

2.1.3 Smart technologies

The objects that become smart after the implantation of intelligent technologies can communicate with the users by actively or passively way. Nowadays, smart technology is one of the most upcoming innovation as in combination with others technologies (Bluetooth, Wireless Networks, RFID), it gives, in physical things, an independent and dynamic role. Advances in smart buildings, in smart vehicles, in smart environment and personal robotics are some of the leading areas.

2.1.4 Nanotechnology

Nanotechnology is used to improve products in many industries and disciplines, including medicine, energy and transport. This kind of technology is growing and is connected with the capacity to observe and supervise the atoms and molecules. Meanwhile, it can have other various forms of use, such as to develop special sports equipment for therapeutic applications [12].

2.2 Applications

Nowadays, the emerging IoT has impacted many application domains (Fig 2.) and, according to the researchers, up to 2020, it is estimated more than 30 billion devices will be wirelessly connected to the IoT [11][1].

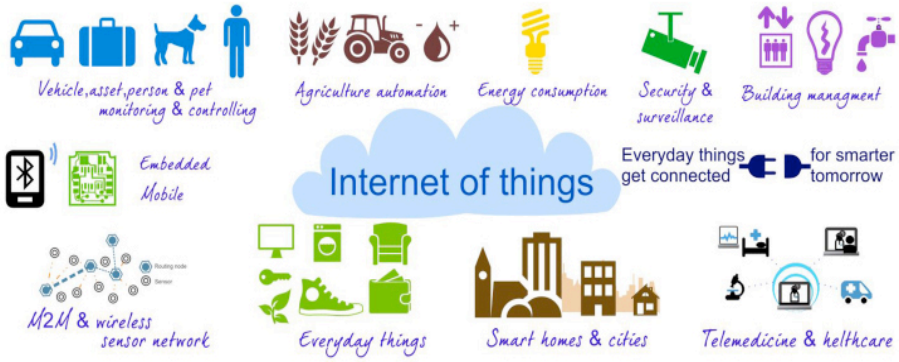

Fig. 2. Application of IoT. Source: datasciencebe.com

The IoT appends to physical objects both an interactive and dynamic task, providing them the capacity to interact with users via embedded systems. Ubiquitous computing and the IoT are become entwined with our everyday lives in many areas, such as health, transport, agriculture, public sector, almost without our noticing it. Although, it seems that the IoT will change future lifestyles, further work is required in safety and security.

3 Cloud Computing and its Aggressiveness

Cloud Computing (CC) implies the use, through Internet technologies, of computers and their resources, like storage, system software, applications software, software packages, user applications and data, in a global scale. Obviously, access to unlimited resources permits among the others, flexibility in choosing the appropriate and most updated software, and collection of innovative applications and packages. At the same time, CC, by allowing the selection of low cost storage capacity of various computer systems and other computer devices income, provides immense scalability and reduces performance cost of CC systems considerably. An additional benefit to the end users of CC services is related to compatibility issues. Through CC, in most cases, end users can take advantage of advanced and updated versions of available software regardless of their platform specifications. But, "no pain no gain". The high benefits of CC cost high risks in inconsistency and security. And as

everybody knows how to efficiently deal with inconsistency, security remains in danger and presents the main issue for the CC system developers.

Cloud's source characterizes its deployment model. Therefore, in case of a private model, the owner of a cloud is an organization allowing its use to its own members. Quit often, these clouds are used for data and specific applications sharing. A public model of a cloud provider is usually offering services to customers. Examples of such providers are Yahoo, Google, Amazon etc. A model that provides applications and any kind of recourses to citizens of a community belongs to a community model. In such a case, an administrator or a number of community members are usually collectively operating the specific cloud. Finally, there is a hybrid model of cloud providers in case of any scheme combining more than one model of the above [22].

The large number of cloud users, the variety of platforms used and the unlimited number of physical devices operating under external protocols may result to cloud expose in various threats. For this reason, organizations are concerned of their data not being safe enough. This fear for corruption is intense in case of sensitive data. Fear intensifies more because users do not know the security measures taken by the provider's liability. Clearly enough, authorization, authentication, data confidentiality, privacy, trust, integrity and data availability in CC and cloud environments are opened research areas.

3.1 Authorization

Cloud providers are responsible for security measures of their system and specifics for identification of their clients whoever they will be (enterprises, staff, end users in general). In most of the cases clients, by providing their credentials (usually their name and password), are entering to the cloud and make use of their privileges which, in general, are, or should be, different from one user to another [22, 3]. If a user, in order to fully exploit an application available to a cloud, has to store his own data files on this cloud, he must be ensured that his file will not be modified without his authorization. Otherwise severe damage may be caused and this may be fatal, particularly in the case of systems using sensitive data. Therefore, authorization is necessary and it should be enforced by specific security precautions. As a conclusion, the structure of a CC system should be very well organized and provision of access to clients should follow restrictions according to their roles and needs.

3.2 Availability

Since unlimited clients may use a CC system, system's provider must be able to support it under a heavy network load. Varying protocols and bandwidths may also reconsidered. Also, in case of hardware failures operations should be not discontinued and alternative routes should be available. Failures may be also caused by external attacks of malicious users who are trying to bring down the system [22, 3, 14, 24]. Thus, availability is a critical issue and characterizes the quality of CC service.

3.3 Trust

In CC environments trust is an important issue since it has to do not only with the cloud provider and his precautions but also with the behavior of the rest of parties involved. Clients play a significant role since they may not always behave as they are expected. Users of this kind may cause damage to an unsuspecting client, his data files and expected outcome of his operation. Therefore, CC system providers must ensure their clients that all safety measures have been undertaken and trust should be their mutual feeling of minimized risks of the available cloud [22, 20].

3.4 Integrity

In CC environments data and hardware integrity refer to the system's protection by not allowing to unauthorized users to access or modify or make any modifications to the hardware used or its drivers. CC system' users may cause damages of this kind intentionally or unintentionally. In both cases unsuspected clients are victims of a malicious operation [22, 20].

4. e-Authentication - e-Identification: Ironing Computer Security

Currently, the complexity and multi-level architecture of computer systems pose risks to application security and integrity of citizens' personal data. Additionally, the developers make unremitting efforts to meet all the application security gaps but most of the time without success. The design of security in IT systems is closely linked to the techniques, procedures and administrative measures as well moral-social attitudes, principles and assumptions, sheltering from any threat of accidental or intentional. The most crucial point in the design process of safe policies is the identification and characterization as confidential data that are used and protected. In addition to, principles of Integrity of Information, Confidentiality and Availability Information security policies should incorporate besides the terms of authenticity, authentication and Identification. The new emerging technologies (IoT, CC), that we note above, facilitate greatly the daily life of citizens. However, security plays a key role in the sustainability of an application or that of a service. On the one hand, the system may defend information and data from unauthorized access and, on the other hand, people use and trust these services more easily because they have high levels of security.

Furthermore, milestone are the cross-border services that allow increased citizens' mobility within the European states, as personal documentation and data are following citizens throughout Europe. STORK 2.0 that recently finished, launched by European Commission and presents a series of cross-border digital services that to (i) enable the Digital Single Market focusing on legal entities & attributes which is important for boosting SMEs & private sector, (ii) Facilitates cross-border eGovernment applications and (iii) Reduces administrative burdens of the companies & individuals wishing to provide services across borders. In this project, there are 58

partners from 26 participating countries, including Greece. EID, eAU and e-SIGN are the novel milestones for secure cross-border electronic transactions and foundation blocks of the Digital Single Market.

4.1 Security in Internet of Things

The widely usage of IoT is an indisputable fact and by 2020 it is estimated to reach 50 to 100 billion of devices [20]. In not-so futuristic world of IoT, security, privacy, and trust need to be considered as fundamental design parameters. Experts are trying to enhance the security of IoT framework, many security aspects must be covered in order to maximize the security, such as, secure booting of devices, role-based access controls, Firewalling and IPS and device authentication [21][18].

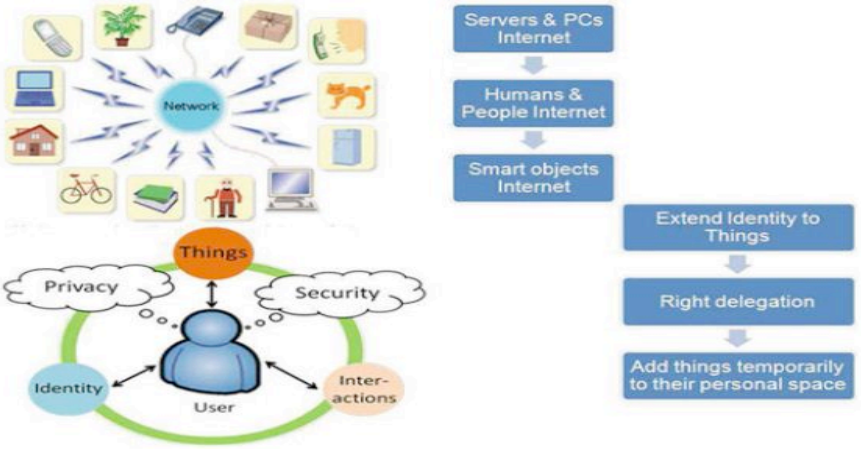

Fig. 3. Security in IoT. Source: http://link.springer.com/book/10.1007%2F978-3-319-06811-4

4.2 Security in Cloud Computing

The security of CC or just cloud security is a developing sub-domain of computer, network, and, information security roughly. It indicates an extensive set of policies, technologies, and controls that are used to secure data, applications, and the related infrastructure of CC. The CC security can be separated into two categories: security concerns encountered by cloud providers and security concerns encountered by their customers. Although, most of cloud providers are considered to be frontrunners in security issues, the last techniques that were used are: data encryption, data masking, authentication and privacy [2].

4.3 Security in cross-boarder Services

The goal of cross-border services is to eradicate the current digital barriers that citizens face, and the businesses' flexibility in the single market via e-gov services. In essence, they allow citizens to establish new e-relations across borders, just by presenting their national eID. EAU and eID, in combination with the e-Signatures are the key enablers for the interoperability and reliability of cross-boarder services [6][7][8]. The following figure shows the identification process and which the providers that are involved.

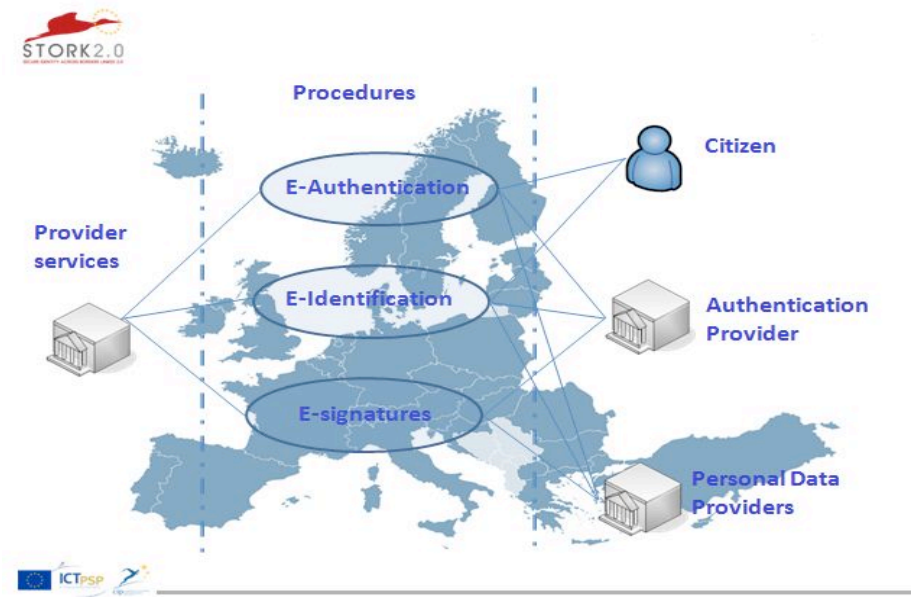

Fig. 4. Authentication Procedures. Source: https://www.eid-stork2.eu/

5 Smart e-Government Agricultural applications

Traditional e-Government systems, adopted by many countries for the last ten years or so, can be transform to Smart e-Government Systems (SeGSs) using last developments and plethora of applications of CC, Big Data and IoT technologies. This transformation, by the application or combined with recent research results, and actually readymade platforms, on eID, eAU and e-SIGN, is further extending their use and benefits to citizens, business or Government agencies. In the case of Agriculture, SeGSs present a special interest due to the global recession in economy which necessitates considerable reduction in production and distribution cost of the agricultural production.

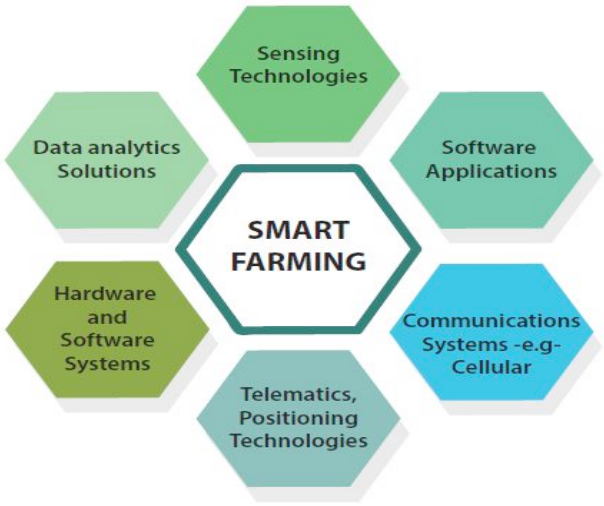

Fig. 5. Different Technologies in Smart Farming. Source: Beeocham Research Ltd

On e-Commerce, the decisive benefits in using e-Government systems of the mode G2B, B2B or B2C and their expected value for trust, time and money, are those enabling e-business to perform efficiently improving at the same time their security, accessibility and reliability. For example, let us consider a B2B application of import-export activity of agricultural products. The transformation of this application to the corresponding B2B smart e-Government system, by making full use of eID, eAU and eSIGN platforms, will further minimize bureaucracy, time and cost spent in ordinary transactions. E-transactions, through the above platforms, will lower burden in conducting business in person (physical or enterprise).

Exports and imports of agricultural products are important day-to-day activities and are usually supported so far by e-Government B2B systems conducted, in the name of farmers, by intermediaries and, in the best case, by their Unions. Small Medium Agricultural Enterprises (SMAEs) are paying heavy duties on this. Evidently in the cross-border environment, a SMAE cannot conduct business without guaranteed eID, eAU and eSIGN SeGSs. Therefore the use of SeGSs is of enormous significance for SMAEs in conducting business at least in cross-border environments (for example between the member States of the EU).

As we saw in previous sections, the IoT and the CC can work beneficially for every domain. Moreover, the perfect combination of them can "take off" and promote fast development in any sector. Agriculture is considered as a key driver of the economy in many countries, especially those of South Europe like Greece, which is in recession in economy. For this reason, there is an urgent need for transformation and upgrading of the agricultural sector and making full use of the benefits of Smart Agriculture.

These days, farmers and breeders have new dynamic roles and challenges as utilizing the technology and many interactive tools to their smart phones or their tablets. So, based on key techniques of IoT, Big Data, GPS and CC, farmers have endless functions, such as environment monitoring and control systems, real-time weather forecasting reports, monitoring of food supply chain and soil and plant monitoring [3].

Smart Agriculture is now an unprecedented research area, which has numerous features, utilizing the sensors technology and ICTs. Among the benefits of innovative technologies are: improvement in the use efficiency of inputs, increased profitability, sustainability and food safety [3]. Additional, using RFID technology, farmers can monitor the plant's growth and monitor farm's important data (soil constituent, soil humidity, light, wind and air). Smart farms, now, aims to for making many agricultural works more autonomous and context-aware [14].

A concrete area of Smart Agriculture with a plethora of SeGSs is that of Precision Agriculture. Automation of farming procedures, climate monitoring, crops health data, diagnosis of farm machinery breakdown and early detection of natural disasters synthesize an upcoming Smart Farming era [24].

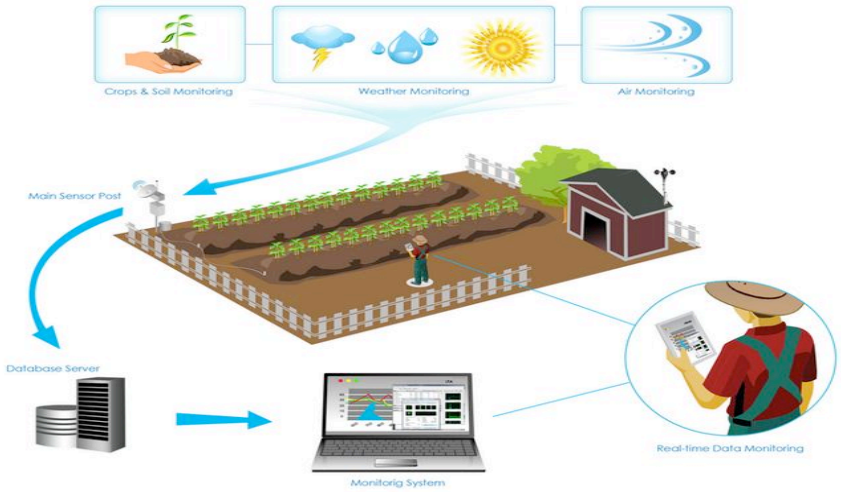

Fig. 6. Smart Farming. Source: http://www.iotphils.com/solutions/precision-agriculture/

6 Discussion

Under the World Wide Web (WWW) a new computing paradigm, with innovative applications and integrated e-government systems inspired by advances in CC, Big Data and IoT, is now prevailing. This computing paradigm dictates the extent, the applicability, the availability and reliability of the new e-government systems especially designed for unpredictable so far application areas in Agriculture,

Forestry, Food Science and the Environment. That is why the current technological epoch could be characterized as the epoch of Smart e-Government Systems (SeGS).

The main benefit of SeGSs is the combination of enormous quantities of data and information, available through the above mentioned technologies, with no or very low cost by the free usage of software and hardware globally available. The main shortcoming comes from the security aspect and its parameters. In this respect a lot of research effort is already producing useful results. Governmental organizations, realizing the importance of SeGS in sensitive and financially significant application areas, have announced political strategies, major programmes and specific projects. In particular, the European Union (EU), since the turn of the century, has put too much emphasis for the development of platforms by its member States enabling them to implement the EU's objectives. An important such EU's principle is that of free movement of its citizens with no cross-border obstacles. Other, no less significant objectives, are those of the financial sector, integrated banking system, e-health and e-justice systems. These systems have now developed and been applicable by advances in the latest EU's STORK2 project. This project is on line with launched seven priority areas in the "Europe 2020 Strategy". One of this areas should be dealt with “wider deployment and more effective use of digital technologies” as a way of preparing EU economy of the next decade [8]. Specific actions undertaken by member States form the Digital Agenda for Europe which, in turn, is leading to a Digital Single Market (DSM). Of course the main characteristic and prerequisite of DSM implementation should be the connectivity of all Europeans (citizens, businesses or administration staff) to high speed Internet though G2C, G2B, B2C and G2G mode [10, 21, 16].

In this paper has been pointed out, though reference to specific SeGSs, that to the above application areas should be added e-Agriculture, e-Forestry, e-Food Sciences and e-Environment. In the latest areas of our interest, security aspects are partly encountered by STORK's successful outcomes on eAU, eID and e-SIGN. The importance of these SeGSs, with the latest features, it becomes more eminent under the current economic recession on the economy of countries like Greece heavily dependent on export of agricultural products.

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Informing Residents to Natural Disasters: the Case Study Results from Northern Evros, Greece

Paraskevi Karanikola[1], Stilianos Tampakis[2], Vasileios Drosos[2] and Nikolaos Varlamis[2]

[1]Department of Forestry and Management of the Environment and Natural Resources, School of Agriculture and Forestry, Democritus University of Thrace, Orestiada, Greece, e-mail: pkaranik@fmenr.duth.gr
[2]Department of Forestry and Management of the Environment and Natural Resources, School of Agriculture and Forestry, Democritus University of Thrace, Orestiada, Greece

Abstract. Greece is a country which is often affected by catastrophic natural phenomena (especially forest fires, floods and earthquakes).The study aimed to identify the information provided to residents of Northern Evros, concerning natural disasters. Primarily, residents were asked to express their opinion about the importance of recording their views via questionnaire and to evaluate natural disasters depending on their risk degree. Moreover, it was investigated whether the residents were informed for the recovering actions from a natural disaster, if they were aware about the role and the responsibilities of the Civil Protection Service and which sources of information they used. They were also asked about the way the information about the real size of a natural disaster should be formed by the media and the reason why scientists talked to the media after a catastrophic natural disaster. Furthermore, the views of the residents were analyzed regarding operations that would be done temporally, after a catastrophic risk for recovery and from which shared state services in their region, for every kind of natural disaster separately.

Keywords: Natural hazards, risk perception, risk awareness, information, Media

1 Introduction

Natural disasters are the impact of oversized natural phenomena (Ye et al., 2012; Karanikola et al., 2014). A disaster refers to a relatively unexpected event which typically overwhelms existing resources and threatens life or property (Gasparotti and Rusu 2012; Georghiu et al., 2013). People are unequally affected by extreme natural events in terms of mortality, morbidity and financial losses (Teodorescu and Cristin, 2002; Werg et al., 2013).

When a region is vulnerable to natural disasters, the citizens should be sufficiently informed about the problem with the correct and adequate information (Singer and Endreny, 1994). In this way the consequences of the phenomenon will be reduced the

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number of victims or the injured (Papatheodorou et al., 2014). However, when a natural disaster happens the citizens should be informed about the actions they should take before, during, or after a natural disaster (Alesch et al., 2012). In such conditions the participation and the cooperation of all public and private entities are quite important providing citizens with information are of course essential, but it is not sufficient (Pearch, 2003; Mercer, 2010). Each incident in which emergency managers disseminate risk information to the news media should be followed by a thorough critique of performance (Lindell and Perry, 1992).

Information and communication present significant advances in disaster prevention and crisis management (Martin and Rice 2012). Knowledge about the citizens' expectations from the authorities and the community, it is important information for the management of natural disasters. This information can be used in the phase of the organization in order to develop the necessary structures in order to satisfy the people's needs. Disaster management and community planning via public participation have become top priority for authorities, organizations and stakeholders in many countries all over the world (Pearch, 2003; Mercer, 2010; Martin and Rice, 2012). In European Countries there are a few papers on this subject (Mansourian et al., 2006; Fleischauer et al., 2012; Wachinger, 2013).

The study focuses on the perceptions and knowledge of the residents of Northern Evros about natural disasters. In particular the citizens evaluate natural disasters proportionally with their hazard degree, the actions that residents should take in order to face a natural disaster, the role of stakeholders and specifically the role of the Civil Protection. Also, they evaluated the different sources of information about natural hazards and comment on the role of the broadcast media and scientific community.

2 Research Methodology

The research was carried out with the application of a face to face structured questionnaire. The research area of this paper was Northern Evros (967.5km^2) the northernmost regional unit of Greece that includes the city of Orestiada and the 33 around villages with total population 39,485 (under the national census of 2011). It borders with Turkey to the east, across the river Evros, and it borders with Bulgaria to the north and the northwest) (Municipality of Orestiada, 2015).

Random sampling was applied. The population ratio that is also the impartial evaluation of the real ratio of the population p and the assessment of the standard error of the population ratio of the s_p without correction of the finite population as the sampling fraction is small, has been calculated using the formulae of simple random sampling.

To calculate the size of the sample we thought it would be necessary to conduct pre-sampling with a sample size of 50 individuals. The size of this sample was calculated based on the formulae of simple random sampling (where t = 1.96 and e = 0.048) (Matis, 2001). Even though simple random sampling without off reset was used, the correction of the finite population can be omitted as the sample size n is small in relation to the population size N (Pagano et al., 2000). More specifically, the

sample size was determined to 400 individuals. The data collection was carried out during the second semester of 2014.

The total of questions which were reported to the possible sources of information constitutes a multi-theme variable on which reliability analysis is applied. In particular, in order to find out the internal reliability of a questionnaire (Frangos 2004), i.e. if our data have the tendency to measure the same thing we used the alpha co-efficient (or reliability co-efficient a-Cronbach). If the alpha co-efficient is 0.70 or bigger it is regarded satisfactory (Howitt et al., 2003) and if it is bigger than 0.80 it is regarded very satisfactory. In practice, it is frequent that smaller reliability coefficients, that is with values no bigger than 0.60, are also accepted.

However, the checking must not only be reliable, it must also be credible and this is done through the application of factor analysis (Sharma, 1996). In particular, we used the method of principal components which is based on the spectral analysis of the variance table (correlation). Regarding the significance of the principal components, the criterion which was used was the one suggested by Guttman and Kaiser (Frangos, 2004), according to which, the limit for the collection of the appropriate number of the principal components is determined by the values of typical roots which are equal or higher to one. Furthermore, we also used the matrix rotation of the main factors applying the Kaiser's method of maximum variance rotation.

3 Results and Discussion

Primarily, the residents of Northern Evros were asked about how important it is to record their view about natural disasters through the questionnaire. The residents considered that it was important (35.8%), very important (27%) and most important (21%) their surveying through the questionnaire (Fig. 1).

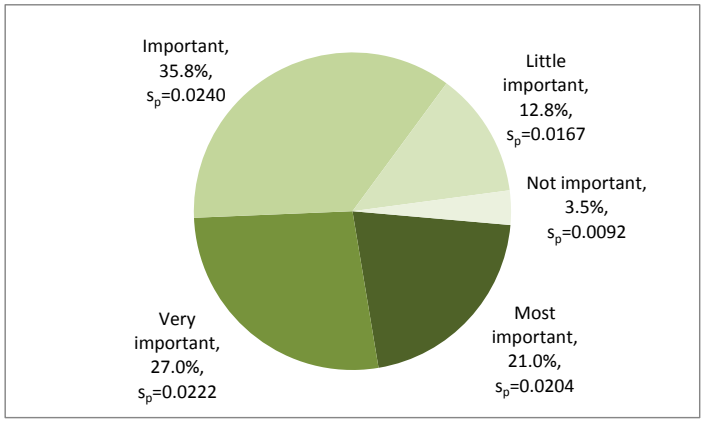

Fig. 1. Significance of surveying residents about natural disasters.

During the interviews residents were asked to evaluate natural disasters according to the degree of risk (Table 1). As very significant characterized from the citizens natural disasters as earthquakes (70.8%), tsunami (57.8%), forest fires (56%), the floods (44.8%) and the volcanic eruptions (45.2%). However, people characterize a natural disaster more dangerous, regardless of the probability of occurrence, unless the negative impact that poses, e.g. the possibility of tsunami in the region is too small, but the disaster that will be caused is huge.

Table 1. Evaluation of natural disasters depending on the hazard degree

		Highly significant	significant	Regular	Insignificant	Highly insignificant
Earthquakes	%	70.8%	19.8%	7.0%	2.0%	0.5%
	s_p	0.0225	0.0199	0.0128	0.0070	0.0035
Forest fires	%	56.0%	32.8%	7.8%	3.0%	0.5%
	s_p	0.0248	0.0235	0.0134	0.0085	0.0035
Floods	%	44.8%	43.8%	10.2%	1.2%	
	s_p	0.0249	0.0248	0.0152	0.0056	
Snow-frost -	%	18.8%	41.0%	34.5%	4.8%	1.0%
	s_p	0.0195	0.0246	0.0238	0.0106	0.0050
landslides	%	19.0%	39.2%	29.2%	9.0%	3.5%
	s_p	0.0196	0.0244	0.0227	0.0143	0.0092
Volcanic eruptions	%	45.2%	24.8%	11.5%	9.5%	9.0%
	s_p	0.0249	0.0216	0.0153	0.0147	0.0143
Tsunami	%	57.8%	14.8%	10.5%	6.5%	10.5%
	s_p	0.0247	0.0177	0.0153	0.0123	0.0153

Informing people plays an important role as it contributes to minimize the catastrophic effects that a natural disaster can bring about, and it can generally reduce human losses. Table 2 presents the degree of which residents of Northern Evros were informed of the actions they should take in case of natural disasters. It was found that the residents were not very informed about the relevant actions that should be taken in case of natural disasters.

According to figure 2 the knowledge of the role and responsibilities of the Civil Protection Agency is rather mediocre.

Table 3 presents the sources of natural disaster information that residents consider as most important. It was found that the internet and education were the most important; however, the internet had a relatively large percentage of negative answers due to the fact that it was not used by older people.

In the above variables reliability analysis was applied, after the appropriate checks. Reliability co-efficient alfa is 0.750 and this result constitutes strong evidence that the grades of the scale are logically consistent, i.e. our data have the tendency to measure the same thing.

Moreover, before we moved on with the application of factor analysis the necessary checks were done. In Table 4 we can see that the factors that were

extracted were three and they all have a characteristic root bigger than 1. Additionally, the second column shows the percentage of variation that is attributed to every factor while the third column shows the percentage of variation that is attributed to every factor after rotation. The bigger the loading of a variable the more this factor is responsible for the total variation of the grades within the variable under consideration. The variables that 'belong' to every factor are those for which the loading (columns 1, 2, 3) is bigger (than 0.5) in this factor.

Table 2. Degree of informing residents of Northern Evros on the actions they should take in case of natural disasters.

		Highly significant	significant	Regular	Insignificant	Highly insignificant
Earthquakes	%	25.0%	30.0%	32.5%	9.8%	2.8%
	s_p	0.0217	0.0229	0.0234	0.0148	0.0082
Forest fires	%	18.0%	23.2%	24.8%	22.0%	12.0%
	s_p	0.0192	0.0211	0.0216	0.0207	0.0162
Floods	%	18.2%	18.5%	25.5%	23.5%	14.2%
	s_p	0.0193	0.0194	0.0218	0.0212	0.0175
Snow-frost -	%	18.5%	21.8%	30.2%	21.8%	7.8%
	s_p	0.0194	0.0206	0.0230	0.0206	0.0134
landslides	%	6.0%	10.0%	19.0%	34.0%	31.0%
	s_p	0.0119	0.0150	0.0196	0.0237	0.0231
Volcanic eruptions	%	6.0%	5.2%	11.8%	24.5%	52.5%
	s_p	0.0119	0.0112	0.0161	0.0215	0.0250
Tsunami	%	6.0%	5.5%	11.0%	26.0%	51.5%
	s_p	0.0119	0.0114	0.0156	0.0219	0.0250

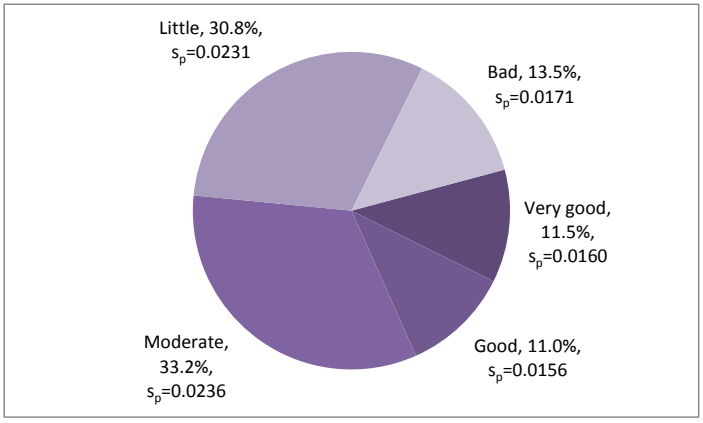

Fig. 2. Knowledge of the role and responsibilities of the Civil Protection Agency.

Table 3. Sources of natural disaster information.

		Very important	important	Mediocre	Insignificant	Very insignificant
Family and friends	%	15.2%	34.2%	37.5%	10.8%	2.2%
	s_p	0.0180	0.0237	0.0242	0.0155	0.0074
Education	%	36.5%	31.2%	24.5%	5.5%	2.2%
	s_p	0.0241	0.0232	0.0215	0.0114	0.0074
Television-radio	%	33.0%	38.2%	23.0%	4.8%	1.0%
	s_p	0.0235	0.0243	0.0210	0.0106	0.0050
Newspapers - magazines	%	21.5%	31.0%	32.5%	11.2%	3.8%
	s_p	0.0205	0.0231	0.0234	0.0158	0.0095
Books- encyclopaedias	%	26.5%	30.8%	27.8%	11.2%	3.8%
	s_p	0.0221	0.0231	0.0224	0.0158	0.0095
Internet	%	55.2%	28.8%	12.2%	2.8%	1.0%
	s_p	0.0249	0.0226	0.0164	0.0082	0.0050
Brochures	%	15.0%	30.2%	33.5%	14.8%	6.5%
	s_p	0.0179	0.0230	0.0236	0.0177	0.0123
Voluntary organizations	%	17.2%	22.5%	32.2%	18.2%	9.8%
	s_p	0.0189	0.0209	0.0234	0.0193	0.0148

Table 4. Table of Factor Loadings, before and after rotation concerning the sources of information.

Variables	Factor burdens					
	before rotation			after rotation		
	1	2	3	1	2	3
Family and friends	0.418	0.305	0.615	0.031	0.160	**0.787**
Education	0.651	0.014	0.421	0.409	0.230	**0.618**
Television-radio	0.584	-0.635	0.210	**0.856**	-0.100	0.215
Newspapers -magazines	0.756	-0.393	0.030	**0.795**	0.241	0.193
Books- encyclopedias	0.674	0.061	-0.397	0.415	**0.661**	-0.079
Internet	0.473	-0.284	-0.481	**0.542**	0.365	-0.330
Brochures	0.661	0.407	-0.119	0.139	**0.727**	0.262
Voluntary organizations	0.573	0.622	-0.180	-0.078	**0.827**	0.239

The burdens are given in bold show which variables included to each factor.

Factor 1 includes the variables 'Television-radio', 'Newspapers -magazines' 'internet' and we can name it as 'typical sources of information'.

Factor 2 can be named as 'alternative sources of information' and includes the variables 'books- encyclopaedias', 'brochures' and 'Voluntary organizations' could also be included in this factor even if their figure is below 0.5. The second variable with a same figure is also included in Factor 1. Therefore the two variables can be considered to act as bridges between Factor 1 and Factor 2.

Factor 3 includes the variables 'Family and friends' and 'education' and we can name it as 'information from the close environment'.

The information provided to the public, after a natural disaster, should be immediate and accurate (Lekkas, 2000). Unless accurate information is provided, citizens will created the sense-perception that authorities are trying to conceal the truth, while in the opposite case, when the information is disseminated and difficult to understand. In this case, misunderstandings arise, that lead to influence of panic prevails.

The majority of the participants (61.0%) stated that the information concerning the size of a natural disaster should be given quickly and in the real size (Figure 3). In fact according to residents the information is given immediately but exaggerated in size (Figure 4).

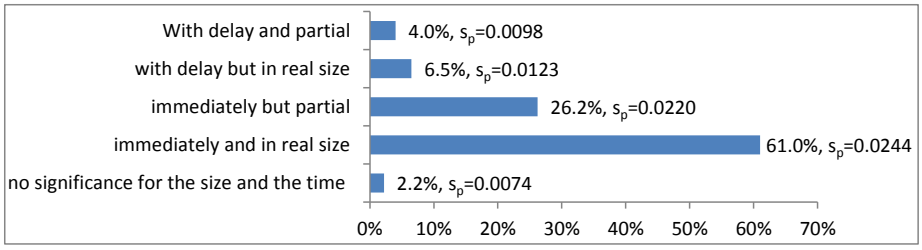

Fig. 3. Residents' opinion about how they want to informed about natural disasters

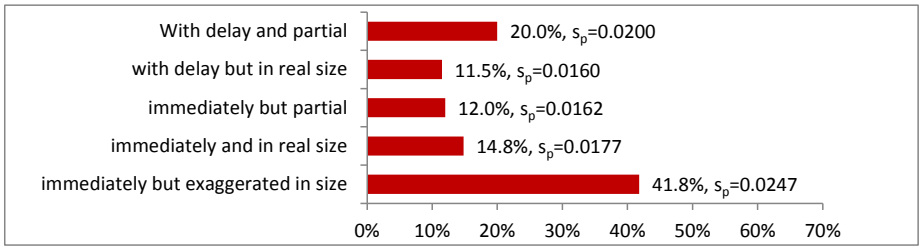

Fig. 4. Residents' opinion about how they really informed about natural disasters

Despite the importance of communication interaction between the media and the public, it often turns out to be inaccurate. The inhabitants of Northern Evros were asked to assess the information provided by the media. It is not coincidental, that they believe in a percentage of 41.8% that the information is given quickly and with exaggeration regarding the size and each reporter is trying to have the exclusivity of the news of a natural disaster. It should be mentioned that in extreme conditions after a catastrophic natural disaster is difficult to collect information, but this does not

justify the dramatization of the news. A way out in informing citizens is the specialists' involvement in the media. The scientist who deals with the mitigation and prediction of disasters is an excellent source of information which can be exploited from the journalists (Lekkas, 2000). Scientific community may tend to believe that individuals and organizations underestimate the risks to which they are exposed. On the other hand, many of these individuals and organizations believe that the scientific community overestimates the risks. Scientists are often questioned about their theories, as if scientific facts were no more than one group's beliefs (Alesch, 2012).

Finally, the inhabitants of Northern Evros were asked to assess the participation of scientists in the media after a natural disaster (Table 5). Generally, the residents believe that the scientists talk to the media after a natural disaster because they usually want to promote themselves as scientists (44.5%), while they believe that they often do so in order to inform the people (48%), to calm and support them (45.2%), to inform them what they were not able to support it earlier (37%) and in order to put the State under pressure for economic support during their research (43.5%).

Table 5. The views of residents in Northern Evros about the attitudes of natural disaster scientists in broadcasting media.

		Always	Often	Rarely	Never
to inform the people	%	36.8%	48.0%	11.5%	3.8%
	s_p	0.0241	0.0250	0.0153	0.0095
to calm and support citizens	%	24.5%	45.2%	23.8%	6.5%
	s_p	0.0215	0.0249	0.0213	0.0123
to promote themselves as scientists	%	44.5%	35.0%	18.2%	2.2%
	s_p	0.0248	0.0238	0.0193	0.0074
to pressure the state for economic support during their research	%	21.8%	43.5%	27.5%	7.2%
	s_p	0.0206	0.0248	0.0223	0.0130
to inform citizens what they were not able to support it earlier	%	33.5%	37.0%	23.0%	6.5%
	s_p	0.0236	0.0241	0.0210	0.0123

4 Conclusions

The current work describes how the public is informed and responds to warnings about natural disasters. According to the results of the research, residents consider natural disasters as very significant, depending on their degree of risk, the earthquakes, tsunamis, forest fires, floods and volcanic eruptions. Moreover, they are better informed for the natural disasters that affect their region more often, such as earthquakes and forest fires, snow and frost, while they are less informed on the role and the responsibilities of the Civil Protection. Concerning the sources from which they derive information on natural disasters, citizens consider the internet as the most important source of information today.

For the briefing on the size of a natural disaster, the majority of residents of Northern Evros considered that it should be done immediately and with accuracy regarding the size of the disaster. Unfortunately, the citizens affirmed that, although public information on the natural disaster size was fast, it was exaggerated, thereby causing confusion, stress and fear to the community. Even though scientists were the most reliable source of information, the citizens believe that their appearance is not only to calm, inform and support people but also to pressure the state for economic support of their relevant research programs on natural hazards.

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E-Government for National Forest Parks in Greece

Christiana Koliouska[1], Zacharoula Andreopoulou[2], Fedra Kiomourtzi[3], Basil Manos[4]

[1]Laboratory of Forest Informatics, Department of Forestry and Natural Environment, Aristotle University of Thessaloniki, Greece, P. O. Box 247, 54124, e-mail: ckolious@for.auth.gr
[2]Laboratory of Forest Informatics, Department of Forestry and Natural Environment, Aristotle University of Thessaloniki, Greece, P. O. Box 247, 54124, e-mail: randreop@for.auth.gr
[3]Laboratory of Informatics in Agriculture, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece, e-mail: fkiomour@agro.auth.gr
[4]Department of Agricultural Economics, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece, e-mail: manosb@agro.auth.gr

Abstract. Electronic government services strengthen the internal market and complement European Union legislative acts and their effectiveness in a number of domains where ICT can improve delivery of services. Today, there has been observed an increasing interest in applying electronic government to different business sectors such as the environmental sector. Effective and successful management of National Forest Parks relies on a complete understanding of the goods and services which they provide to the society. This paper aims to study electronic government websites concerning the 10 Greek National Forest Parks and analyze the websites as to their qualitative and quantitative features. Then, the electronic services model adoption of the websites is assessed. The electronic government websites are classified in electronic services adoption stages starting from a simple presence of the government agency in the Internet to the total electronic services integration through multiple Information and Communication Technologies tools and applications provision according to content features accomplished by the websites. The findings can be helpful for managers, policy makers, web designers, environmentalists and government agencies.

Keywords: Electronic government, Information and Communication Technologies, Electronic services adoption, National Parks, Website assessment.

1 Introduction

Lately, sustainability has been globally a key goal at local and regional level. The environmental governance and the management issues related to decisions which verify performance have also gained a continuously growing focus. Information and Communication Technologies (ICT) have become the means to make government more accountable, transparent and effective. ICT are key elements supporting the growth of electronic governance (e-governance) initiatives and projects (Andreopoulou et al, 2011).

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Electronic government (e-government) has been defined as "the use of ICT, and particularly the internet, as a tool to achieve better government" (OECD, 2003). In Europe, governments are under intense and sustained pressures to remain competitive on a global level, in responding to a variety of now well-known and profound challenges (demographic change; environmental impacts; natural resource shortfalls; social cohesion, worrisome waste streams, and the like) (European Union, 2013). E-government services strengthen the internal market and complement European Union legislative acts and their effectiveness in a number of domains where ICT can improve delivery of services such as in procurement, health, environment, mobility and social security, and support the implementation of citizens' initiatives with ICT tools (European Union, 2010). Implementation of e-government can produce a form of relationship such as: Government to Citizen (G2C), Government to Business (G2B) and Government to Government (G2G) (Widodo et al., 2013; Hazlett and Hill, 2003).

Further, there has been observed an increasing interest in applying e-government to different business sectors, such as the environmental sector. The contribution of protected areas such as National Forest Parks has been proven to be highly significant for the preservation of biodiversity and of genetic material, for maintaining the productive capacity of the related ecosystems, for the protection of man-made, cultural elements and for rural development as a whole (Arabatzis and Grigoroudis, 2010; Colchester, 2004).

The aim of this paper is to study e-government websites of the 10 Greek National Forest Parks. The websites that enhance government management services in the areas of National Forest Parks in Greece, by using ICT tools and applications, are analyzed. The websites are analyzed as to their qualitative and quantitative e-services features. The retrieved e-government websites are also classified in the four e-services adoption stages, starting from a simple presence of the government agencies in the Internet to the total exploitation of ICT tools and applications according to their content features.

2 Materials and Methods

E-government websites of the 10 Greek National Forest Parks are retrieved from the Internet using various keywords and combinations such as 'Greek National Forest Parks', 'Management Agencies of National Forest Parks', 'Ainos National Forest Park', 'Vikos-Aoos National Forest Park', 'Oiti National Forest Park', 'Olympus National Forest Park', etc. The websites are retrieved using the large-scale hypertextual search engine "Google" which provides much more satisfying results than other existing search engines (Berry and Browne, 2005; Langville and Meyer, 2006).

Initially, qualitative analysis is performed to the collected e-government websites in order to examine the type of common features (e-services) found in these websites. There were various features introduced in the retrieved websites. These features are then used to describe variables x_1, x_2, …x_n. The features that are used are described in Table 1.

Table 1. Variables attributed to e-government services to be achieved by the website

Variable	Feature	Variable	Feature
X_1	two or more languages	X_{16}	links to other companies etc
X_2	information about products-services-activities	X_{17}	various topics of interest
X_3	contact information	X_{18}	downloadable files
X_4	local information	X_{19}	calendar application
X_5	digital map	X_{20}	event calendar application
X_6	audiovisual material	X_{21}	celebration calendar application
X_7	live web camera	X_{22}	social media sharing
X_8	search engine	X_{23}	social media profile
X_9	sitemap	X_{24}	forum
X_{10}	updated enterprise information	X_{25}	related sources of information
X_{11}	online survey	X_{26}	third person advertisement
X_{12}	online communication form	X_{27}	newsletter
X_{13}	weather forecast	X_{28}	RSS
X_{14}	website visitor tracker	X_{29}	code access
X_{15}	Frequently Asked Questions (FAQ)	X_{30}	personalization of the page, trace, safety

Then a quantitative analysis is carried out, in order to examine the presence or absence of common e-services features. A 2-dimentional table is developed that examines the existence of features and the values of 1, for the existence, and 0, for the non existence of the features, are attributed to variables X_1 to X_{30}, respectively. The total amount of e-services features achieved by each website is also studied. For each e-government website, the total number of achieved features is attributed to a new variable, named t. Variable t presents the sum of e-services features, and therefore it takes a value between 1 and 30.

2.1 Classification of E-government Websites in the Four Stages of E-services Adoption

E-government websites are further classified in four categories, each one representing a stage of usage of ICT tools and applications and e-services adoption. Various researchers have described a four stages adoption model (Gossain and Kenworthy, 2000; Rao et al., 2003) that represents four different distinctive categories or adoption stages for an agency with varying strategic objectives and aspirations. These stages are: presence, interaction, transaction and transformation. The grouping depends on the features achieved by a website.

"Presence" is the stage that ensures that the website is accessible in many ways by the users who want to visit the website and interact with the interface in order to gain some information. It is ensured just a simple presence in the Internet for advertisement purposes. "Interaction" addresses the engagement of website visitors and enables them to complete whatever process or experience is provided by the

website. Moreover, in the second stage of interaction, there are some limited actions enabled for the users, such as navigation through the website and the provision of various links.

"Transaction" is related with the e-shoppers experience in the purchasing process and payment orders. Furthermore, in the third stage of transaction there are enabled applications that enhance the transactions where the final user can play a major role, such as electronic exchange of texts and self-services provided for the user. "Transformation" includes the quality of communication and transaction along with responsiveness and reliability to the potential customers. Therefore, in the fourth stage of transformation the value chain is optimized while users have the possibility for online orders and payments while they are simultaneously in position to check the stage of their order.

According to that method, websites that achieve t<=4 , only one to four (1-4) features, are classified in the stage of *presence*, while websites fulfilling five to 21 (a total 5<t<21) features belong in the stage of *interaction*; websites that accomplish 22 to 26 (22<t<26) features belong in the stage of *transaction*, while websites accomplishing the majority or all of the features, a rate 27 to 30 (27<t<30), represent the stage of *transformation* (Andreopoulou et al., 2007; Andreopoulou et al., 2008).

3 Results

The research through the search engines on the Greek Internet resulted in the retrieval of 64 e-government websites that promote the 10 National Forest Parks in Greece.

Concerning the area of Olympus National Forest Park, all e-government websites (7) belong to the second stage of e-services adoption model, the 'interaction' stage. As for the area of Parnitha Forest National Forest Park, seven e-government websites belong to the 'interaction' stage and one e-government website belongs to the third stage of e-services adoption, the 'transaction' stage. There have been retrieved five e-government websites about Parnassos National Forest Park which are classified in the stage of 'interaction'. As for Sounio National Forest Park, all e-government websites (7) belong to the second stage of e-services adoption model, the 'interaction' stage. Concerning the area of Iti (Oiti) National Forest Park, all e-government websites (5) belong to the second stage of e-services adoption model, the 'interaction' stage. Concerning Samaria National Forest Park, one e-government website belongs to the first stage of e-services adoption, seven e-government websites belong to the second stage of e-services adoption model and two e-government websites belong to the third stage of 'transaction'. As for Valia Calda - Pindos National Forest Park, all e-government websites (10) belong to the second stage of e-services adoption model, the 'interaction' stage. There have been retrieved four e-government websites about Prespes National Forest Park which are classified in the stage of 'interaction'. Concerning Vikos - Aoos National Forest Park, the seven e-government websites belong to the second stage of e-services adoption model, the 'interaction' stage.

Table 2. E-services adoption stages of e-government websites per National Forest Park

National Forest Park	Stage 1 "Presence"	Stage 2 "Interaction"	Stage 3 "Transaction"	Stage 4 "Transformation"	E-government websites per National Forest Park
1. Olympus	0	7	0	0	7
2. Parnitha	0	7	1	0	8
3. Parnassos	0	5	0	0	5
4. Enos (Ainos)	0	3	0	0	3
5. Sounio	0	7	0	0	7
6. Iti (Oiti)	0	5	0	0	5
7. Samaria	1	5	2	0	8
8. Valia Calda, Pindos	0	10	0	0	10
9. Prespes	0	4	0	0	4
10. Vikos - Aoos	0	7	0	0	7
Total	1	60	3	0	64

4 Conclusion

The research in the Greek Internet retrieved 64 e-government websites in the areas of the 10 officially recognized National Forest Parks in Greece. The existence of e-government websites constitutes a first and very important step for the enhancement of government management services in these protected areas with the huge natural, ecological and cultural importance. There are identified 30 different e-services features introduced in each e-government website.

Most e-government websites deal with Valia Calda – Pindos National Forest Park, while the least websites serve the area of Enos (Ainos) National Forest Park. Moreover, most e-government websites belong to the second stage of e-services adoption, the 'interaction' stage. These websites apart from the informational material about the provided products - activities – services and the contact information, provide some information about the National Forest Parks with pictures, videos or maps, some useful links to related issues and some limited actions enabled for the user, such as navigation through the website and the provision of various links.

The findings of the study are concurrent to those of similar studies in other western countries about the evolution of e-government among National Forest Parks. The results show that the websites which enhance e-government services need to improve the interaction with the local population. The existence of e-government websites constitutes a first and important step for the promotion of local and sustainable development action. Nevertheless, their association with the local

population is primarily based on the possible citizens' access to the internet society and in the adequate use of internet from the citizens or not. So, it is essential for the state to provide internet access to the vast majority of the population.

Findings can be helpful for managers and policy makers while planning activities and implementing innovative technological changes, such as the functional and effective websites as also for web designers while designing website of similar interest in order to fulfil certain features and characteristics aiming to optimize the websites that promote protected areas and to generally improve effectiveness of e-services.

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Integration of Production Control and Enterprise Management Systems in Horticulture

Cor Verdouw[1,2], Robbert Robbemond[3], Jan Willem Kruize[3]

[1]LEI Wageningen UR, Wageningen, The Netherlands, e-mail: cor.verdouw@wur.nl
[2]Wageningen University, Information Technology Group, Wageningen, The Netherlands
[3]LEI Wageningen UR, Wageningen, The Netherlands

Abstract. Production processes in horticulture are increasingly industrialized. Greenhouses have developed towards high-tech production plants that are highly automated by advanced systems for climate control, irrigation, crop monitoring, harvesting, internal transportation, sorting and packaging. At the same time, horticultural production nowadays is a complex managerial task, which needs advanced management information. However, this information is often registered manually in enterprise management systems. This paper aims to contribute to a better integration of production automation systems and enterprise management systems in the Dutch horticulture. It investigates the current situation and existing related standards (ISOBUS and ISA-95). Moreover, the paper identifies barriers for the adoption of integration solutions, including the economic situation, a decrease of the high-end market, a low willingness to cooperate, a relative low scale of growers, a high perceived complexity and path dependency, a negative perception of the relative advantage and a limited willingness of growers to invest.

Keywords: Production and enterprise integration; Interoperability; ISA-95; ISOBUS; Horticulture; Adoption barriers

1 Introduction

Production processes in horticulture are increasingly industrialized. Greenhouses have developed towards high-tech production plants that are greatly automated by advanced systems for climate control, irrigation, crop monitoring, harvesting, internal transportation, sorting and packaging [1]. At the same time, horticultural production nowadays is a complex managerial task, among others due to scale enlargement, volatile markets and stringent quality and environmental standards [2]. As a consequence, there is a high need for advanced management information. However, much of the information that is generated on the workfloor is not registered automatically in enterprise management systems. The level of integration of automated systems in the greenhouse is still poor [1], leading to the following negative effects:

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- It takes farmers much time and effort to collect, convert and exchange necessary data manually, while the risk of making errors is high;
- A lot of valuable data generated by greenhouse automation systems is not used in decision-making;
- Transparency and accountability requirements often lead to administrative burdens;
- Greenhouse automation systems cannot be instructed and controlled by enterprise management systems, which results in errors and less efficient and effective production processes.

Hence, the objective of this paper is to contribute to a better integration of production automation systems and enterprise information systems in the Dutch horticulture. More specifically, it investigates the current situation and available standards, and identifies the barriers for the adoption of integration solutions. Established standards and associated best practices from the international production industry are currently not incorporated in software solutions in the Dutch horticulture sector. Therefore their expected impacts on improvements in efficiency and efficacy of production processes in the Dutch horticulture sector are expected to be considerable.

2 Methodology

The present research has been carried out as part of the research and innovation program the Digital Greenport Holland. The Digital Greenport Holland is the Public Private Partnership (PPP) of Greenport Holland in which businesses, knowledge institutes and the (national) government are working closely together towards a common vision and action plans on digital information management and standardization in the Dutch horticultural cluster [1]. The core of this Public Private Partnership is formed by three active industry associations for chain information in the Dutch horticulture, i.e. Frug I Com (fruit and vegetables), Floricode (flowers and plants) and EDIbulb (flower bulbs).

The research was carried out in four phases: i) Definition of the research scope: relevant processes, information systems; ii) Inventory of related standards; iv) Assessment of the current situation through in-depth structured interviews; and iv) Identification of the main adoption barriers for integration solutions in the horticultural sector. In total 5 industry experts, 6 growers and 7 technology suppliers were interviewed based on a structured questionnaire. The respondents were selected based on the input of the business experts of the Digital Greenport Holland.

The remainder of this paper introduces the results following these research phases: definition of the research object, related standards and adoption barriers.

3 Definition of the research scope

The research focusses on the control of production activities in horticulture. Horticultural production is concerned with the transformation of plant material (seeds, cuttings, etc.) and inputs such as soil, water, energy, fertilizers and pesticides, into packaged and identifiable vegetables, fruits, flowers, plants and other horticultural products. Figure 1 visualizes the production activities including seeding, plant cuttings, bedding out young plants, planting young plants, irrigating, fertilizing, climate control, pest control, monitoring crop growth, monitoring production conditions, harvesting, picking, internal transportation, quality inspection, sorting, packing and preparing for shipping. Production activities are carried out with the help of resources including human resources, machines, greenhouses, fields, buildings and other facilities. Production control ensures that the production system's objectives are achieved, also if disturbances occur. Basically, this implies that the performance is measured, the measurements are compared with norms and in case of disturbances, corrective or preventive actions are effected. This is done on multiple levels with different time horizons.

The present research focusses on the integration of enterprise and production control. The next section will introduce two relevant standards for this interface.

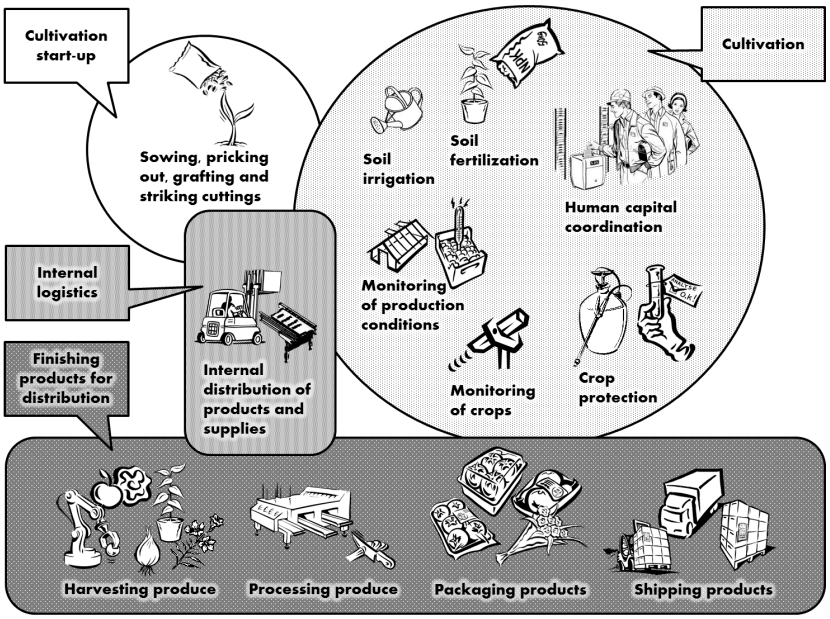

Fig. 1. Main production processes in horticulture

4 Existing standards for production and enterprise integration

The inventory of related standards identified ISOBUS and ISA-95 as the most relevant related standards.

4.1 ISOBUS

ISOBUS is a universal protocol for electronic communication between implements, tractors and computers, which is widely accepted by the agriculture industry around the world [3]. The Agricultural Industry Electronics Foundation (AEF) and Association of Equipment Manufacturers (AEM) work together to boost the development and application of ISOBUS technology. The most important topic is the interaction between agricultural vehicles and their implements. Also, the interaction between task controllers and Farm Management Information Systems is of increasing interest to the developing work groups.

The core of ISOBUS is the ISO-11783 standard “Tractors and machinery for agriculture and forestry - Serial control and communications data network”. ISO-11783 specifies a serial data network for control and communications on forestry or agricultural tractors and mounted, semi-mounted, towed or self-propelled implements [4]. ISO 11783 comprises 14 parts [5], i.e. a general standard for mobile data communication physical layer (part 1), and standards for the data link layer,

network layer, network management, virtual terminal, implement messages application layer, power train messages, tractor Engine Control Unit (ECU), task controller and management information system data interchange, mobile data element dictionary, diagnostics services, and sequence control (parts 2-14).

The main advantages of the ISOBUS language are that one terminal can control several machines instead of having a separate terminal for every machine. Machines and implements can be connected to the vehicle plug & play. The terminal, subsequently maps and displays the control and configuration options. For the farmer this leads to reduction of costs and the ease of use is increased, because the central terminal enhances the farmer's oversight and control while carrying out his tasks. Additionally as the developments on the interaction of control terminals and farm management information systems progress, more benefits of the systems arise as the link between enterprise planning and task management improves and the quality of process information increases.

4.2 ISA-95

The International Society of Automation (ISA) is a non-profit technical society for industrial automation and instrumentation with about 36000 members (isa.org). ISA is recognized as a leading one of the foremost professional organizations in the world for setting standards and educating industry professionals in automation. Two of its standards have become international standards that are important for the purpose of the present paper: ISA-88 and ISA-95.

ISA-95, formerly known as S95, is a framework that focusses on the integration of office automation and production automation and mechanization [6, 7]. It is widely adopted in the international production industry, among others, in the pharmaceutical, petrochemical and food processing sectors.

The framework was developed because the wide usage of Enterprise Resource Planning (ERP) systems in the industry raised the need to integrate these systems with the operational production systems, but many integration projects still fail. The main intended benefits of ISA-95 are: i) to decrease costs and complexity of integration of business logistics systems and manufacturing systems, ii) to enable comparisons between best practices for the operation of manufacturing, iii) to facilitate discussions about it by creating a common vocabulary and framework, and iv) to decrease costs and complexity of the integration of systems that operate manufacturing systems [7].

ISA-95 consists of models and terminology about: i) information exchange between enterprise management systems and manufacturing operations systems; ii) activities in manufacturing operations systems; and ii) exchanged information within manufacturing operations systems. More specifically, Figure 2 discerns the four control levels of ISA-95 which are based on the Purdue Reference Model [7, 8]:

- *Level 0 & 1*: the actual physical processes and its sensing and actuation;
- *Level 2*: manufacturing operations management systems that supervise, monitor and control physical processes, especially Supervisory Control and Data Acquisition systems (SCADA), Programmable Logic Controllers (PLC) and Distributed Control Systems (DCS);

- *Level 3*: systems, which manage the work flow of batch, continuous or discrete production operations, especially Manufacturing Execution Systems (MES);
- *Level 4*: business planning & logistics systems that manage business-related activities of production, including production planning and scheduling, material use, shipping and inventory management, especially in ERP systems.

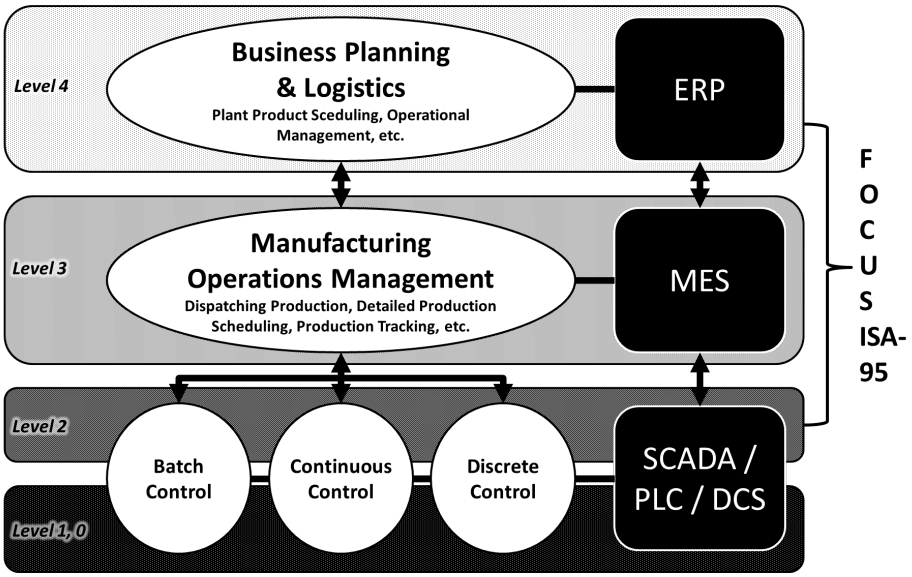

Fig. 2. Control Levels as defined in part 1 of ISA-95 [6, 7]

The core of the framework is the definition of the information flows that link

ISA-95 focuses on the integration of levels 3 and 4. The integration of the control levels 0,1 and 2 are supported by other ISA standards, including ISA-88. The ISA-95 framework includes six standards (www.isa95.org):

- *Part 1 "Enterprise Control System Integration 1: Models and terminology"* [7]: standard terminology and object models based upon the Purdue Reference Model, which can be used to decide which information should be exchanged;
- *Part 2 "Object Model Attributes"* [9]: describes the attributes for every object that is defined in part 1;
- *Part 3 "Activity Models of Manufacturing Operations Management"* [10]: provides reference models for describing production, quality activities, maintenance and inventory activities on the shop floor;
- *Part 4 "Object and Attributes for Manufacturing Operations Management Integration"* [11]: technical specification of the information that is exchanged between different manufacturing operations management categories and activities (as defined in part 3);

- *Part 5 "Business to Manufacturing Transactions"* [12]: defines transactions that specify how to collect, retrieve, transfer and store information of objects for enterprise-control system integration (as defined in the other parts);
- *Part 6 "Messaging Service Model"* [13]: specifies the transaction of part 5 in a set of messaging services.

Moreover, the data models of ISA-95 are implemented in XML schemas in the Business to Manufacturing Markup Language (B2MML) standard by the Manufacturing Enterprise Solutions Association (MESA) [14].

A core element of the ISA-95 framework is the definition of the information flows that link enterprise management (level 4) with production activities on the shop floor (level 2 and down) as visualized in Figure 3. These flows are concerned with [7, 10]:

- *Operations definition:* instructions about the work that is to be carried out;
- *Operations capability:* information about capabilities needed for the work defined;
- *Operations request:* information about the accompanied work schedule;
- *Operations response:* information about the work performance.

The information flows are broken down into detailed data streams for the materials, equipment and personnel relevant to the information exchange. The standard sets up specific models for this information and data breakdown for quality management, production control, maintenance management, and inventory management. Additionally ISA-95 describes the information model that underlies the data exchange. This information model is the basis for the definition of messages which are modelled in detail in UML diagrams. MESA implements these data definitions in XML message.

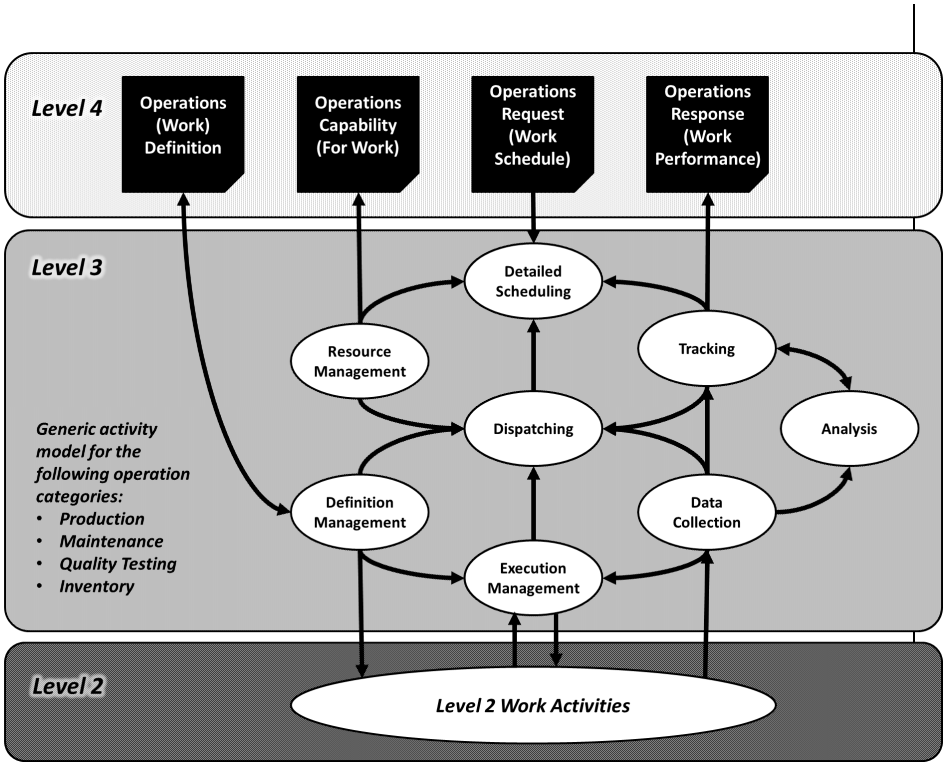

Fig. 3. Information flows with level 3 control activities [10]

5 Production and enterprise integration in the Dutch horticulture

5.1 Current situation

The interviewed experts and suppliers indicate that a majority of the growers have not yet integrated their production and enterprise management systems. Most of the others have implemented specific interfaces that are fully customized by system vendors. There are a few examples that implemented a separate middleware layer, which however is not based on standards. Only one example of an standardized interface is found. This standard was developed based on ISA-95 and B2XML by Plantform, an association of around 75 indoor plants growers that cooperate in the development and implementation of integrated enterprise management systems [15]. However, the Plantform standard has a limited scope since it specifies the

communication of a sales order from the enterprise management system to an automated picking system.

In sum, it can be concluded that, although the Dutch horticulture is very innovative in the application of new production technologies, it lacks behind in the integration of production and enterprise management systems in comparison with the regular manufacturing and processing industry. The next section explains this situation by discussing the adoption barriers as addressed in the interviews.

5.2 Adoption barriers

The relative low adoption of integrated production and enterprise management systems can be explained by the barriers that are visualized in Figure 4.

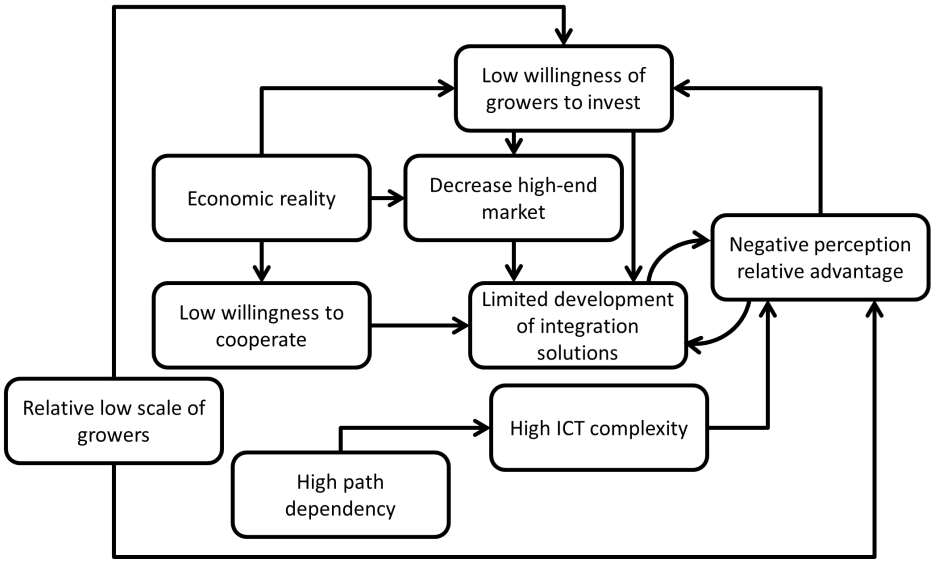

Fig. 4. Adoption barriers as addressed by the respondents

The *economic situation* was identified as a significant barrier for the adoption of integration solutions. In 2014, 37% of greenhouse horticulture businesses faced some degree of liquidity problems [16]. Approximately one fourth of businesses needed to at least defer more than half of their loan repayments. As a result, there is a low financial headroom for innovation. However, this is expected to be a temporal effect: in the first quarter of 2015 the confidence among greenhouse growers increased slightly [16].

The Dutch market is a high-end market for suppliers of horticultural productions systems. Due to the economic situation and the resulting low willingness to invest, the *emphasis shifts to (more low-end) markets* that demand less advanced solutions and that do not necessarily require a good connectivity.

The integration of different production and enterprise management systems requires a close cooperation between growers and suppliers, and among suppliers. The respondents indicate that currently there is a *low willingness to cooperate*. An important reason is the increased competition due to the economic situation. Other reasons mentioned include the absence of a dominating organization that can force cooperation, a mismatch in innovativeness and a lack of trust.

In 2013, on average size a Dutch greenhouse employed 32 Full Time Equivalents (FTE) [16]. Although horticultural companies are relatively large in comparison with other agricultural sectors, *growers are still low-scale* in comparison with the manufacturing and processing industry, which are the main users of the ISA-95 standards.

Solutions to integrate production and enterprise management systems are perceived to be *complex*. Suppliers expect that it will deeply impact the architecture of their systems. For growers it is difficult to understand how business processes will change by the implementation of integrated solutions.

The perceived complexity is enlarged by a high *path dependency* due to the installed base of systems with a limited interoperability. These systems are often based on outdated technologies that do not allow for a 'plug-and-play' integration approach. As a result, integration is much more difficult and costly than in case of greenfield implementation. There high dependency on the existing systems and suppliers (vendor lock-in) often blocks innovation with respect to system integration.

The respondents recognize the benefits of a better integration of production and enterprise management systems, especially if integration focuses on specific cases such as order climate control, picking & harvesting, sorting & packaging, and production time registration. However, most interviewed growers expect that the benefits are still outweighed by the costs, in particular because of the expected complexity and the relative low company scale. They perceive a *negative relative advantage* and consequently they take a wait-and-see attitude.

A combination of a negative perception of the relative advantage, a relatively low scale and the economic situation results in a *limited willingness of growers to invest* in integration solutions. If new systems are selected, price is a dominating factor, while the connectivity is often not taken into account. As a consequence, suppliers are confronted with an unfavorable business case to invest in integration technology.

6 Discussion

The objective of the present research was to contribute to a better integration of production automation systems and enterprise information systems in the Dutch horticulture. It has investigated available industry standards, the current situation, and it has addressed main barriers for the adoption of integration solutions.

The main related standards addressed are ISOBUS and ISA-95. Especially the ISA-95 standard is well suitable to the integration of production automation systems and enterprise information systems in horticulture. The sector is highly industrialized, resulting in many similarities with the manufacturing industry.

However, the research shows that, although the Dutch horticulture is very innovative in the application of new production technologies, it lacks behind in the integration of production and enterprise management systems in comparison with the regular manufacturing and processing industry. This low adoption can be explained by the following barriers that are addressed in the interviews: the economic situation, a decrease of the high-end market, a low willingness to cooperate, a relative low scale of growers (in comparison with the manufacturing and processing industry), a high perceived complexity, a high (path) dependency on the existing systems and suppliers, a negative perception of the relative advantage and a limited willingness of growers to invest in integration solutions.

The poor integration of production and enterprise management systems in the Dutch horticulture contrasts with the high need for advanced management information. This contract is expected to limit further growth and it could even threaten the current strong international competitive position. To break out of this situation, the sector is advised to:

- Stimulate the awareness of benefits in concrete cases and demonstrations;
- Stimulate the cooperation between growers and suppliers, and among suppliers and among growers;
- Reduce the perception of complexity by providing practical tools and applicable knowledge;
- Take the lead to develop international horticulture-specific standards based on existing reference frameworks and standards such as ISA-95;
- Don't focus on standardization as such, but emphasize the importance of integration for a professional management.

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Use of Branch and Bound Algorithms for Greenhouse Climate Control

George Dimokas[1], Constantinos Kittas[2]

[1]Department of Agriculture Crop Production and Rural Environment, University of Thessaly, Greece, e-mail: gedimokas@gmail.com
[2]Department of Agriculture Crop Production and Rural Environment, University of Thessaly, Greece

Abstract. Optimization of greenhouse climate management during winter period is an issue that intensely preoccupied researchers over the last two decades as it is directly linked to energy saving, products quality, and reduction of chemical inputs. Goal of this project was the use of Branch and Bound algorithms in order to obtain the optimize greenhouse climate control. For this purpose a biophysical simulator were used and experiments were carried out in the farm of the University of Thessaly in the region of Volos (Greece), during the autumn and winter periods of 2005 and 2007. Branch and Bound algorithms used for two different climate scenarios and the results showed the difference between the classical greenhouse climate control and the control according B & B optimization technique. Finally results showed the contribution of optimization technique to increase tomato production and to reduce energy consumption.

Keywords: Branch and Bound Algorithms, Climate Control, Greenhouse, tomato production, optimization.

1 Introduction

Most of the greenhouse climate control problems show large number of possible solutions, which are therefore entered the need for finding the best "route" or optimal solution (Dimokas 2009). The use of advanced optimization models, may contribute to the variation of the classical greenhouse climate management during winter period which usually consists in the management of heating by specifying two desired thermostat setting one temperature, for the night and one for day period, based mainly on the producer experience (Tap et al. 1993). The desired values of the temperature setting (set- points) are depending on the type and the age of crop. Nevertheless, experimental work showed that the growth and development of many vegetable and horticultural species appears to respond more to an average daily temperature than on accurate temperature evolution during the day (Heuvelink 1989, Vogelezang et al. 2000).

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The heating of the greenhouse by the sum of the temperatures (Integrated Temperature Control) during the day has already been applied in several floriculture (Rijsdijk and Vogelezang 2000) and horticultural species (De Konning 1988), allowing an energy saving of about 10 - 20% (Bailey and Seginer 1989).

Many experimental projects are referred to optimization of greenhouse climate. The optimal control is one of the processes studied further (van Henten 1994, Tchamitchian and Tantau 1996). According to this method, a model function of the optimization system is used, consisting of differential first degree equations and an algebraic criterion that measures the result quality of this operation.

The principle of Bellman (Bellman 1957), allows to solve the problem with dynamic programming, while the principle of Pontryagin (Pontryagin et al. 1962) uses the Lagrange multipliers to convert the power system model and the algebraic criterion to one function for minimization. These experimental works have not yet reached to commercial systems. Goal of this project was the use of Branch and Bound algorithms in order to obtain the optimize greenhouse climate control for energy saving.

2 Material & Methods

Branch and bound (BB or B&B) is an algorithm design paradigm for discrete and combinatorial optimization problems, as well as general real valued problems. A branch-and-bound algorithm consists of a systematic enumeration of candidate solutions by means of state space search: the set of candidate solutions is thought of as forming a rooted tree (Figure 1) with the full set at the root. The algorithm explores branches of this tree, which represent subsets of the solution set. Before enumerating the candidate solutions of a branch, the branch is checked against upper and lower estimated bounds on the optimal solution, and is discarded if it cannot produce a better solution than the best one found so far by the algorithm.

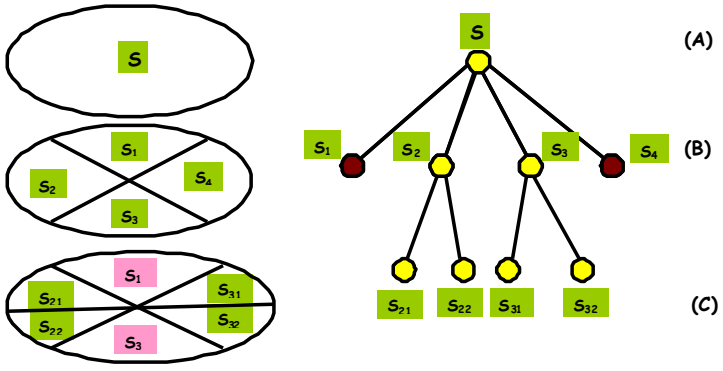

Fig. 1. Display in the form of a tree Branch & Bound method.

The method of branching and bounding (Branch & Bound) has found application in solving various and important optimization problems, eg, in integer programming, nonlinear problems, programming problems, plant sitting problems (Dimokas 2009).

2.1 Optimization Method for Greenhouse Climate Control

Optimization of the biophysical simulator with the use of Branch & Bound method uses a space selection strategy in order to be investigated in accordance with the algorithms (1), (2) below. The algorithm (1), is responsible for setting the (*Vh*) ventilation (system controller) inside the greenhouse

$$Vh = 0.1 \cdot (1 + (\frac{RH - pRT}{(Abs \cdot (RH - pRT)) + 0.5})) + \frac{1}{e \cdot^{(\frac{pb1 - Ti}{pc1})}} \quad \textbf{(1)}$$

where pb_1, pc_1, pRT, the values of the variables that have to be optimized in order to give the best solution. At the same time the algorithm (1), uses the biophysical simulator and more specifically the results obtained for the relative humidity (*RH*) and the air temperature inside the greenhouse (*Ti*), during the process of optimization.

The algorithm (2) below is responsible for determining the operation of the (*Vt*) heating system (system controller) within the greenhouse.

$$Vt = 0.1 \cdot (1 + (\frac{RH - pRT}{(Abs \cdot (RH - pRT)) + 0.5})) + \frac{1}{e \cdot^{(\frac{pb2 - DTi}{pc2})}} \quad \textbf{(2)}$$

where pb_2, pc_2, pRT, the values of the variables that have to be optimized in order to give the best solution. At the same time the algorithm (2), uses the biophysical simulator and more specifically the results obtained for the relative humidity (*RH*) and the air temperature difference inside and outside the greenhouse (*DTi*), during the process of optimization.

The problem to be solved is to minimize the objective function *J* to a range of possible solutions, S:

$$\min J = \sum (Fcon) - \sum (D.W.F) \quad \textbf{(3)}$$

where $\sum (Fcon)$ is the total energy gives the heating system inside the greenhouse, while respectively $\sum (D.W.F)$ the resulting dry weight of mature fruit.

The limiting function used to optimize the biophysical simulator using Branch & Bound method shown below:

$$\min J(one) > \max J(other) \quad \textbf{(4)}$$

Function (4) reject some subset of possible solutions by further exploring inside, to find the possible solution when the above condition is true, that the optimal minimal solution that offers the particular subset is greater than the largest value of another subset.

2.2 Climate and Biological Measurements

The measurements that used to optimize the model were data for tomato production and development simultaneously with the greenhouse climatic data, during the autumn and winter periods of 2005 and 2007. For the experimental periods were used also calculated values by the modified TOMGRO (Dimokas et. al., 2009), for: i) plant development and the number of leaves, fruits, flowers, ii) biomass and fruit production. The aim was to identify differences between the optimization method, and the climate control during the experimental period.

3 Results

This section presents results of treatment followed during the experimental measurements and optimum proposed in accordance with the branch & bound method. The results are giving detailed greenhouse climatic conditions and all features related to the development and production of tomato plants. From these were selected and are presented in the following sections the results concerning: a. number of plants node, b. shoot dry weight, c. leaves dry weight, d. whole plant dry weight, e. simulation curve of windows opening, f. air temperature inside the greenhouse, g. temperature of the greenhouse cover. Values that are used as input variables for the number of nodes, dry weight of leaves, stems and fruits are the same that used of the modified TOMGRO.

3.1 Results of the first simulated period

Initially a variation was observed in greenhouse air - cover temperature and presented in Figures 2 and 3. The optimum calculated values fall short of measured values and this is due to the diversification arising from the way of windows opening. Control of when and how much, windows are opening through the use of the algorithm (1) are indicated in Figure 5. Time variation of window opening rate leads to both reduce the temperature and reduce the humidity inside emissions (data not shown).

Figures 4 (a-d) are showing the variation of calculated values using the modified TOMGRO, and the optimum values obtained after the use of branch & bound method for the number of nodes, dry weight of stem, leaves and whole plant correspondingly. In Figure 4 (a) observed that the climate change does not change the number of plant nodes formed. Correspondingly there is no change at the number of leaves and the number of produced flowers (data not shown). Variation is observed in Figure 4 (b) showing the dry weight of the shoot. The calculated optimal values are above those calculated by the modified TOMGRO. Reverse change is observed in the dry weight of leaves Figure 4 (c), wherein the optimum values are below those estimated by the modified TOMGRO.

Smaller differences observed in Figure 4 (d) illustrating the total output of the plant biomass. The differences are due to the diversification of air temperature

values, Figure 2. Reduction of air temperature leads to a small hysteresis of growth and development of tomato plants. The reduction in biomass production when the plants are in the initial stage of development helps to create more robust plants and there is a regular practice for the producers that mainly use the chemical composition of the nutrient solution and the irrigation dose to achieve it.

3.2 Results of the second simulated period

Figures 8 (a-d) are showing the variation of calculated values by using the modified TOMGRO and best values obtained after the use of the branch & bound method on the number of nodes and dry weight of the shoot, leaf and whole plant respectively for the second experimental period. In Figure 8 (a) is observed that the best calculated values relating to the formation of nodes, are slightly below than those created by the modified TOMGRO. The growth rate resulting from the optimum climate management is less than the one followed during the experimental period. Simultaneously a reduction is presented for the values of shoot dry weight, leaves dry weight and whole plant biomass. The reduction is almost 15.5% for shoot dry weight, 18.5% for leaves dry weight and 17.4% for whole plant dry weight. The decrease results from lower average value for the air temperature, kept inside the greenhouse (Figure 6). It is observed that during the experimental period air temperature was maintained above the fixed price of 15 ºC. A similar differentiation was observed in cover temperature as shown in Figure 7.

The gain from the use of Branch and Bound method was observed and that was the reduction of heating system cost that was calculated 19.72% compared to the initial treatment. The reduction in production costs resulting from the reduction of the heating system cost may lead to a reduction in growth and development of production, but may be a target for the producers. The decrease that caused to plants growth and development can be balanced by increasing the temperature inside the greenhouse to a period prior or after the reduction. This will give to the producers smaller costs for the climate management and simultaneously energy saving.

4 Discussion & Conclusions

The results presented above were according two different climate scenarios within greenhouses, with simultaneous display of the changes caused in the development and production of the tomato crop. The periods used were selected of producer's interest and was at the start of the growing season and the second in the medium.

The study of the results for the first scenario, it is established that the reduction of air temperature contributes to the reduction of both dry weight of leaves and whole plant. The decrease in air temperature was due to the different treatment of the windows operating system (system controller and B & B method).

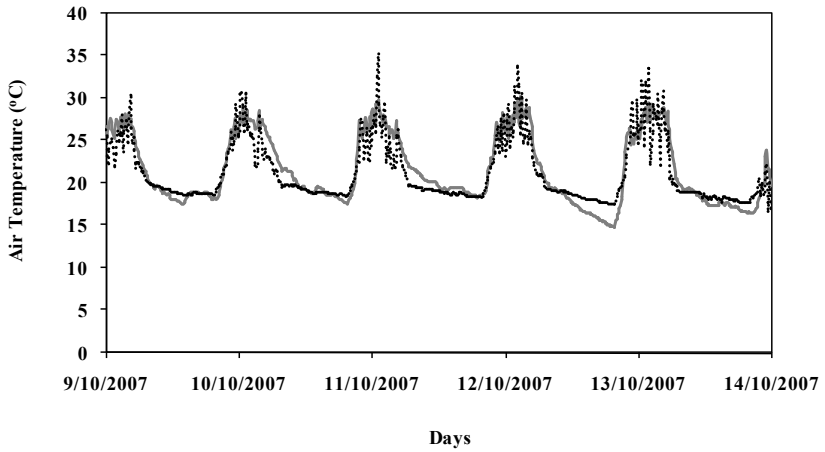

Fig. 2. Variation of measured (–) and optimally calculated (-) values, for air temperature (ºC) during the first simulated period.

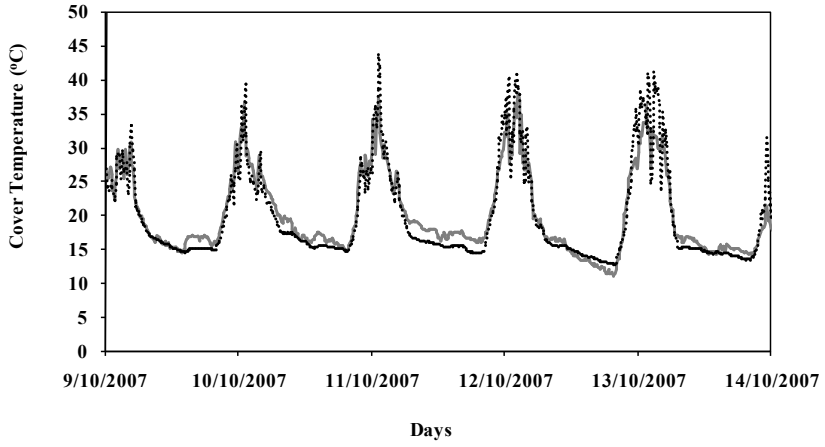

Fig. 3. Variation of measured (–) and optimally calculated (–) values, for cover temperature (ºC) during the first simulated period.

The practice followed in accordance with the use of branch & bound method leads to an opening of a greenhouse window for longer period than that followed in the experimental procedure. However, the reduction of biomass produced when the plants are in the initial stage of development helps to create more robust plants in the future.

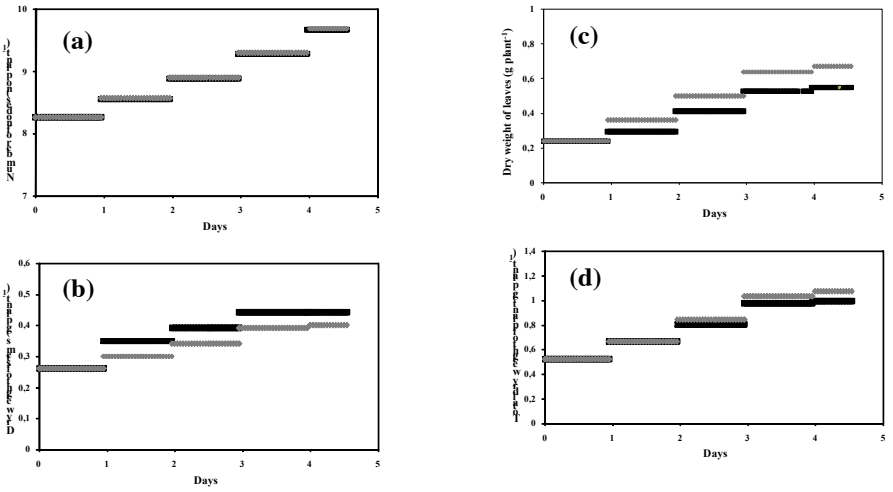

Fig. 4 (a), (b), (c), (d). Variation of calculated values according modified TOMGRO (□) and the optimal values according B & B algorithms (□), growth and biomass production of tomato plants, during the first simulated period.

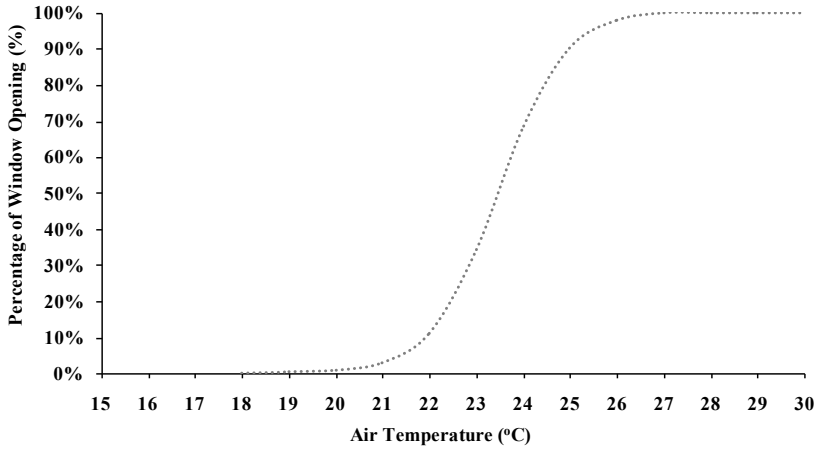

Fig. 5. Percentage (%) of window opening (-), during the first simulated period.

By observing the results of the second scenario it was found that the reduction of production costs by 19.72% led to a corresponding reduction of the biomass production by 15.5% of shoot dry weight, 18.5% of leaves dry weight and 17.4% of whole plant dry weight. However, the reduction caused in plants growth and development can be balanced with an increase in air temperature inside the greenhouse to a period prior to the reduction.

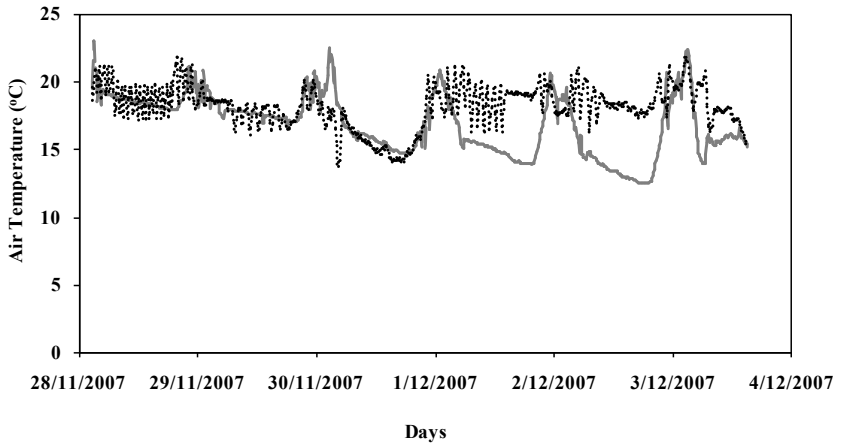

Fig. 6. Variation of measured (–) and optimally calculated (-) values, for air temperature (ºC) during the second simulated period.

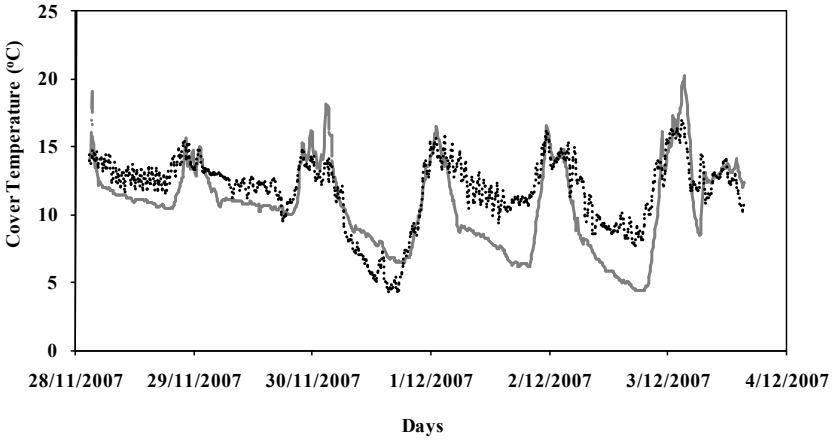

Fig. 7. Variation of measured (–) and optimally calculated (-) values, for cover temperature (ºC) during the second simulated period.

Managing greenhouse climate as mentioned is a daily activity for the producers, which despite its frequency poses many problems. Further analysis of possible climate scenarios will help to create strategies that will shape the conditions for reducing production costs and improving the climate inside the greenhouse units.

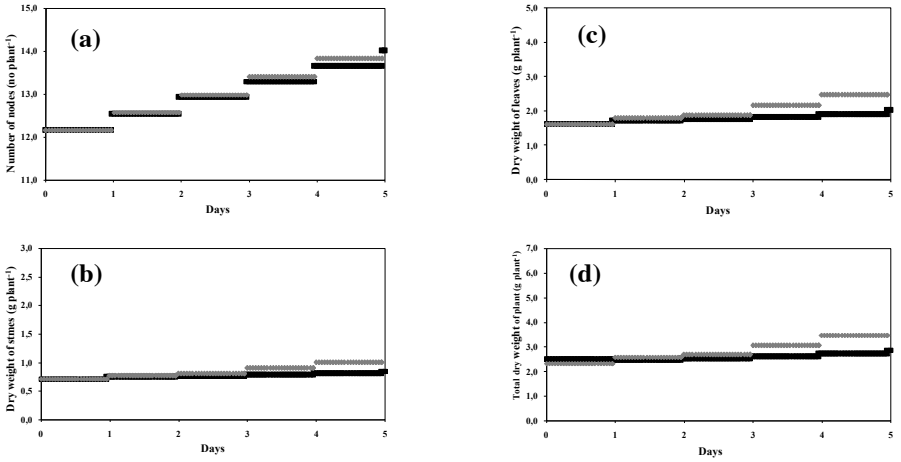

Fig. 8 (a), (b), (c), (d). Variation of calculated values according modified TOMGRO (□) and the optimal values according B & B algorithms (□), growth and biomass production of tomato plants, during the second simulated period.

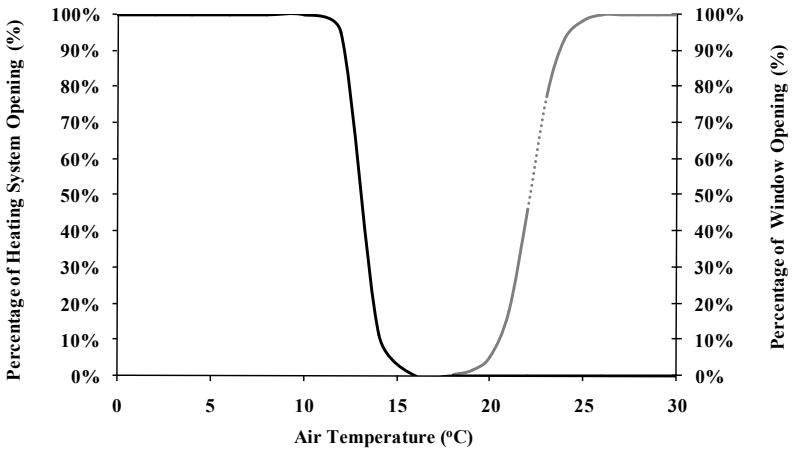

Fig. 9. Percentage (%) of window (-) and heating system (–) opening during the second simulated period.

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Session 2: Engineering & Water Management through ICT

Checking a Culvert Suitability for Flood Wave Routing Within the Framework of the EU Flood Directive

Dimitrios Myronidis[1], Dimitrios Fotakis[2], Konstantina Sgouropoulou[2], Marios Sapountzis[2], Dimitrios Stathis[2]

[1]School of Forestry and Natural Environment, Aristotle University of Thessaloniki, University Campus 54124, Po Box 268, Thessaloniki, Greece, e-mail: myronid@gmail.com
[2]School of Forestry and Natural Environment, Aristotle University of Thessaloniki, University Campus 54124, Po Box 268, Thessaloniki, Greece

Abstract. Flooding is an international problem that represents the most common and destructive of all weather-related natural hazards. Moreover, man-made interventions such as deforestation, clearance of land and the poor design of hydraulic works such as bridges and culverts can often intensify that risk. This paper demonstrates a complete hydraulic study that was performed in a culvert located in Loforrema torrent (N. Greece) so as to examine its suitability for the flood wave routing of different discharges. The hydraulic model HEC-RAS was employed in order to compute the water surface level in the culvert location for flood events with probabilities of 10, 100 and 500 years. The results illustrated that, under all cases, the culvert overflowed putting in great danger the passing vehicles and citizens. Finally, the necessity of complete hydraulic studies is highlighted in order to support decisions in the dimensioning of a bridge in the same location, which it will be sufficient enough to deliver low probability flood events.

Keywords: Culvert, HEC-RAS, Flood Directive, Hydraulic Modeling, Loforrema torrent

1 Introduction

Floods have the potential to induce casualties, violent displacement of people, severe standstill of the economic development and undermining of all economic activities (E.U., 2007). These events are commonly associated with extreme precipitation events, which affect the outflow of the catchments and produce severe floods (Řezáčová et al., 2005, Máca and Torfs, 2009, Jarsjo et al., 2012), whilst it has also been observed the strong dependence between the flood regime and climatic changes (Notta and Price, 1999). Furthermore, sometimes the flood events are accompanied by strong debris flow activity (Stefanidis and Myronidis, 2006; Mitsopoulos and Myronidis, 2006), which maximizes the devastating phenomenon forces. Finally, water floods and water scarcity control ecosystem development and restoration measures (Mongil et. al., 2012).

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This situation has prompted EU to legislate a framework (the Flood Directive) for the reduction of risk to human health, the environment and economic activity associated with floods in the Community (E.U., 2007, Andersson et. al., 2012). The main points of this directive are the development of flood risk maps at a basin scale for flood events with different probabilities (10, 100 years and extreme events) (Myronidis et al., 2009). These maps will be further used to establish flood hazard management plans focused on prevention, protection and preparedness.

However, flood events are not only triggered by natural causes and the irregular hydrologic regime (Sofios et. al., 2008) but also by anthropogenic interventions such as the failures of hydraulic works e.g. dams (Dai et al., 2005) and the inappropriate design of bridges (Ural et al., 2008) and culverts (Stathis and Stefanidis, 2000). Additionally, Stathis and Stefanidis (2000) recorded the loss of human lives when people were trying to pass an overflowing culvert, while Stefanidis and Sapountzis (1999) highlighted the surrounding infrastructures irreversible damage from flood wave due to improper bridge design. A culvert may cause an increase in upstream water surface elevations due to its restrictive cross-section forcing the upstream flood levels to be several meters higher than they would be without the culvert and the embankment (Methods et al., 2003).

This paper summarizes an integrated hydraulic study that was carried out by employing the hydraulic model HEC-RAS (USACE 2010) in a culvert, which is located in the Loforrema stream, so as to check its suitability for flood wave routing of flood events with probabilities of 10, 100 and 500 years. HEC-RAS has been successfully utilized so as to analyze the influence of hydraulic structures on flood dynamics Hailemariam et. al., (2014), while the modeling results showed very good coincidence with the observed water surface levels (Ali et al., 2012). The simulations for theoretical flood waves are a valuable tool not only for avoiding the destruction of the hydraulic infrastructures but also for mitigating the associated flood risks.

2 Study Area

The Loforrema stream is located on the Pieria Mountain in Northern Greece and it intersects with the Serbion-Eginiou road before it outflows into the artificial Lake Polyfitou (Fig. 1). A culvert with 13 multiple identical circular barrels has been established there so to allow the runoff to move from upstream to downstream and to enable safe traffic. This 32.5 Km^2 torrent has repeatedly caused flood events in the past that disrupted road traffic and endangered human lives and it has already flooded twice during 2014. Basin's mean elevation is about 1,390m and it is situated in an inclined terrain with a mean slope of 43.1%, while the main stream length is 12.3km.

The bedrock of the catchment is mainly composed by granites (79%) and gneiss (10.3%). The Corine 2006 Level 3 classification revealed that the study area is well covered by a Coniferous forest (57%). The meteorological data (1977-2013) coming from the Lake Polyfitou dam station revealed that the mean annual precipitation was nearly 514 mm. Moreover, the data provided by a second Meteorological Station in

Velventos, which operated during 1978-1994, showed that the mean annual air temperature was 13.5 0C, while July was the warmest month of the year (24.6 0C).

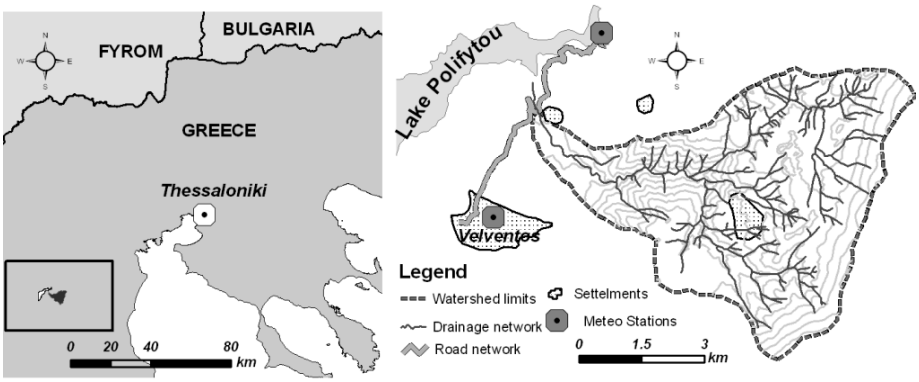

Fig. 1 Study area location map

3 Hydraulic Modeling Methods

HEC-RAS hydraulic software is designed to perform one-dimensional (1-D) steady and unsteady flow calculations to determine water-surface profiles for both natural and prismatic channels (USACE, 2010). The hydraulic modeling process within the HEC-RAS it can be divided in three major phases. Firstly, the input of the channel Geometric Data (river system schematic, the cross-section geometry, the placement of the cross sections, and the culvert/bridges information) were performed. Secondly, the available Flow data (type of flow, peak discharge and boundary conditions) have to be entered while in the last step, the model performs all the necessary computations and several graphical and tabular data are generated.

The River System Schematic is a diagram of how the stream network is connected together. Cross section data represent the geometric boundary of the stream and the cross sections are located at relatively short intervals along the stream to characterize the flow carrying capacity of the stream and its adjacent floodplain (USACE 2010). Once all the necessary cross-section data have been entered, the users can then add any bridges or culverts while HEC-RAS computes energy losses caused by structures in three parts:

a) losses that occur in the reach immediately downstream from the structure where flow expansion takes place

b) losses at the structure itself, which can be modelled with several different methods

c) losses that occur in the reach immediately upstream of the structure where the flow is contracting to get through the opening

The culvert hydraulics routine in HEC-RAS includes the ability to model every type of culvert and is based on the Federal Highway Administrations (FHWA) standard equations (FHWA, 2012). Finally, the cross-section interpolation can be

automated extracted from the DEM (Digital Elevation Model) or it could be surveyed on the field.

Moreover, the type of flow (Steady or Unsteady) must be specified. The Steady flow represent a flow in which the velocity of the fluid at a particular fixed point does not change with time while if at any point the conditions change with time, then the flow is characterized as Unsteady. Once the type of flow is determined and peak flow value has been imported in the model, the Boundary Conditions must be provided. Boundary conditions are necessary to establish the starting water surface at the ends of the river system, while for a subcritical flow regime, boundary conditions are only necessary at the downstream ends of the river system. If a supercritical flow regime is going to be calculated, boundary conditions are only necessary at the upstream ends of the river system. Additionally, If a mixed flow regime calculation is going to be made, then boundary conditions must be entered at both ends of the river system (USACE, 2010).

Finally, once all Geometry and flow data have been entered the program performs all the necessary hydraulic calculations and computes various parameters such as: the water surface profiles for each cross-section, a plot of the water surface elevation versus flow rate for the profiles that were computed, velocity distribution output from the cross section, and others.+

4 Hydraulic Modeling Results

HEC-RAS enable hydraulic engineers to simulate and analyze open channel flow for a reach or a river (Methods et al., 2003). Initially, the reach was defined for a total length of 30m while the culvert was located approximately in the middle of this length (Fig. 2). This was achieved in the field by using a tape measure, a Meridian universal compass MG-3101, which is a foldable combination of Clinometer with Compass, and stadia. Two more cross sections are needed to model properly a culvert: on at the beginning of the contraction into the culvert and a second at the end of the expansion out of the culvert (Methods et al., 2003). These two cross-sections, upstream and downstream of the culvert, were similarly surveyed in the field and were not interpolated from the DEM because the detail relief variation could not be captured.

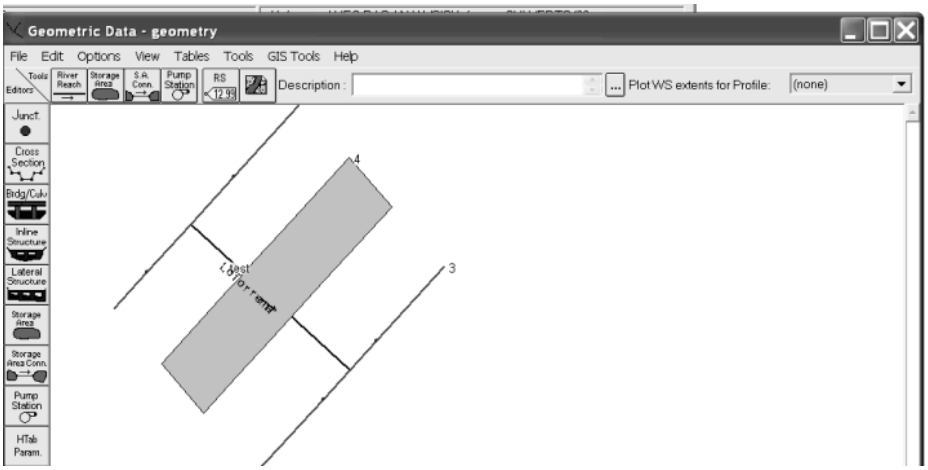

Fig. 2. Stream schematic and culvert location

Each cross-section and the structural details of the culvert where first designed in Autocad 2006 so as to acquire the relative x-y coordinates and then were entered in HEC-RAS. There, the distance from the first cross-section to the next downstream section was entered as 30m for the main channel the left and right over bank locations (Fig. 2). Furthermore, the Manning's n values were entered for the main channel and the overbank locations equal to 0.035 and 0.06 respectively (Linsley et. al., 1988).

The roadway surface elevation was defined from field data as +0.90m from the river bed while the width of the roadway (9m) and the distance to the upstream cross sections (15m) were also defined (Fig. 3). Furthermore, the length of the culvert (9m), its shape (Circular), the number of identical barrels (13), their position in the cross-section, the Manning's n values for Top and Bottom along where also determined. Additionally, the contraction and expansion coefficients of the culvert were assigned values of 0.3 and 0.5 respectively (Methods et al., 2003). Finally, when flow over the roadway approaching the culvert a weir coefficient was calculated using the standard weir equation.

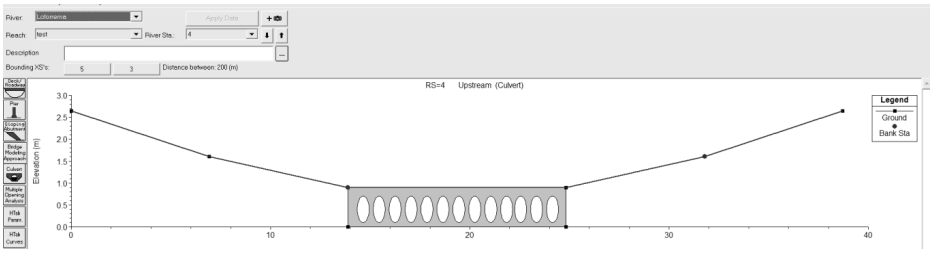

Fig. 3. Culvert data geometry on HEC-RAS

Since the reach is short and uncomplicated the type of flow were determined as steady uniform flow while this assumption suggests that the channel invert slope and the energy grade line slope are equal that rarely describes a real-world situation. However, the latter is sufficient to design and analyze many small-scale flood management systems, such as storm sewers and highway drainage (Methods et al., 2003). Next, from a recent study of peak discharge computations (Sgouropoulou and Myronidis, 2014) peak discharge data for Loforrema stream of 16.0, 23.1 and 29.9 m3/sec were inputted to HEC-RAS which corresponded for flood events with probabilities 10, 100 and 500 year respectively. Additionally, this flow analysis was performed using a subcritical flow regime which suggests that only the Downstream Hydraulic Conditions were entered. For this type of boundary condition the slope of the channel bottom (3.6%) were used in calculating normal depth (Manning's equation) at that location (USACE 2010).

Finally, a steady flow analysis with a subcritical flow regime were simulated for the aforementioned peak discharge values for high, medium and low probability flood events which corresponds to return periods of 10, 100 and 500 years. The main output from the HEC-RAS simulation results were the generation of water surface elevations for each scenarios which were found equal to +0.37m, +0.58m and +0.72m above the roadway surface elevation whereas figure 4 demonstrates for the culvert location the water surface profile for high probability flood event.

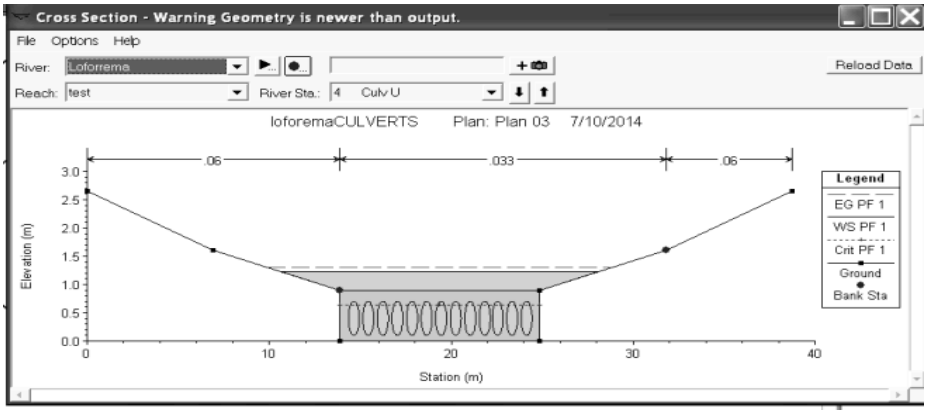

Fig. 4. Water surface elevation for high probability flood event

Thus, under every scenario the culvert is overflowed by considerable height water and it is insufficient of routing even high probability flood events which repeatedly have been manifested in the area. Finally, a bridge with a roadway surface elevation +0.72 from the current road deck it would capable to neutralize any flood risk in the area.

5 Concluding Remarks

The proper dimensions of hydraulic structures can prevent the water from overflowing the structure and it will cancel the associate risks to the human life and property as well as the flood damage to the surrounding areas. This study investigated a culvert's suitability for the flood wave routing of discharges with different probabilities within the framework of the E.U. Flood Directive. Once all the necessary inputs, channel shape and slope, field survey cross-sections, culvert structural specifications and flow data, were inserted to HEC-RAS, the water surface elevations for all scenarios were interpolated.

The analysis of the hydraulic model outputs indicated the replacement of the existing culvert from a bridge, so it would be capable to receive the flood events of low probability (500year return period). Flow capacity with culverts is typically less than of a bridge and the losses are greater while the replacement of a culvert from a bridge is a more expensive solution (Methods et al., 2003). Finally, such types of studies are important to detect a decline in flood prevention ability before a potentially catastrophic flooding occurrence (Shih et al., 2014) and to properly dimension a culvert or a bridge with identical procedures.

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Using ArcSWAT to Predict Discharge in Ungauge Torrents of Thasos Island

Paschalis Koutalakis[1], George N. Zaimes[2], Dimitrios Emmanouloudis[3], Konstantinos Ioannou[4] and Valasia Iakovoglou[5]

[1]Labaratory of Management and Control of Mountainous Waters (Lab of MCMW), Department of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), 1st km Drama, Mikrohoriou, Drama, Greece 66100, e-mail: koutalakis_p@yahoo.gr

[2]Labaratory of Management and Control of Mountainous Waters (Lab of MCMW), Department of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), 1st km Drama, Mikrohoriou, Drama, Greece 66100, e-mail: zaimesgeorge@gmail.com

[3]Labaratory of Management and Control of Mountainous Waters (Lab of MCMW), Department of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), 1st km Drama, Mikrohoriou, Drama, Greece 66100, e-mail: demmano@teikav.edu.gr

[4]Labaratory of Management and Control of Mountainous Waters (Lab of MCMW), Department of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), 1st km Drama, Mikrohoriou, Drama, Greece 66100, e-mail: ioannou.konstantinos@gmail.com

[5]Labaratory of Management and Control of Mountainous Waters (Lab of MCMW), Department of Forestry and Natural Environment Management, Eastern Macedonia and Thrace Institute of Technology (EMaTTECH), 1st km Drama, Mikrohoriou, Drama, Greece 66100

Abstract. Water resources management requires the knowledge of the environmental conditions and hydrologic processes. The development of Geographic Information Systems (GIS) has allowed the use of spatially and physically based hydrologic models in order to simulate the hydrology in a complicated natural system. It is very important to use such tools especially in regions with limited available data. In this context, the objective of this study is to model the hydrologic conditions in the island of Thasos by using the Soil and Water Assessment Tool (SWAT) in a GIS environment. In order to understand the hydrologic processes, it was required to predict the water balance of the island and simulate the discharges of its ungauged torrents. The outputs of the model revealed the simulated values of the hydrologic phases, the torrent discharges and a map that identifies the watersheds with the highest discharges. The results could be used by experts and by every interested authority in order to manage the surface stream water for various purposes, such as suppression of forest fires.

Keywords: hydrologic modeling, water balance, GIS, water management

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1 Introduction

Surface water and especially stream and torrent flow is important for environmental scopes including the sustainability of living organisms and habitats in and adjacent to the stream and torrent but also for human purposes (Arthurton et al., 2007). The proper management can combine these two scopes, mitigate any possible negative influences on the environment but also utilize the stream water that is lost in larger water bodies. Potential water beneficial uses could include agricultural irrigation, production of hydro-electric energy, municipality water supply and wildfire suppression.

It is essential to determine the stream/torrent discharge in order to meet the above objectives. A quick, widely and frequently used technique, but also efficient application is to use hydrologic models (Singh and Woolhiser, 2002). This study describes the implementation of Soil and Water Assessment Tool (SWAT) in order to predict the torrent discharges and propose the necessary management plans to utilize the water.

The study area is the island of Thasos, located in northern Greece that belongs to Kavala Prefecture. It is the northernmost Greek island and the 12th largest by area. The surface of the island occupies about 378 km^2 while the shape of the island is almost rounded and the perimeter is approximately 102 km (Mallios et al., 2009). The terrain is mountainous; while the highest peak is Ypsarion with an elevation of 1203 m. The climate of the island is characterized as Mediterranean (Vlachopoulou and Emmanouloudis, 2014). All of the streams are characterized as intermittent or ephemeral torrents because they do not flow year around and even the major torrents (intermittent) have no flow during the summer.

2 Materials and Methods

2.1 SWAT Model Description

The SWAT model is a physically based, semi-distributed model Neitsch et al., 2011). The model predicts the impact of land management practices on water, sediment and agricultural chemical yields. It can accomplish these takes in large complex basins with varying soils, land-use and management conditions over long periods of time (Neitsch et al., 2011). SWAT processes are separated in two main components. The first one is the land phase where the hydrologic cycle in a basin is simulated based on the water balance equation (Equation 1):

$$SW_t = SW_0 + \sum_{i=1}^{t} \left(R_{day} - Q_{surf} - ET_{day} - w_{day} - Q_{gw}\right) \quad \textbf{(1)}$$

where t is the simulation period, SWt is the soil water content after the simulation period, SW_0 is the soil water content at the beginning of the simulation period, and R_{day}, Q_{surf}, ET_{day}, w_{day} and Q_{gw} are daily values (in millimeters) for precipitation, runoff, evapotranspiration, infiltration and return flow, respectively.

In the second phase the channel hydrology is simulated, more specifically the loadings that are calculated earlier are routed through the stream network of the basin (Neitsch et al., 2011). The spatial configuration of SWAT is performed by dividing the watershed into sub-watersheds based on topography. These are further subdivided into a series of hydrologic response units (HRU) based on unique soil, land use and slope characteristics.

The major benefits of the model are that it is a free product, it is applicable with the available data, it is documented well, it has good technical support through many databases and assistance programs (Gassman et al., 2007) and it has good integration with the Geographic Information Systems (GIS) through ArcSWAT (Winchell et al., 2013).

2.1 SWAT Model Set Up

The data used in this study was the topographic map of Thasos that developed based on the Military Geographic Service that had a scale of 1:50,000. This map was used to create the Digital Elevation Model (DEM) in ArcGIS 10.1 by digitizing the contour lines and the stream network (Figure 1.A.). The SWAT model requires the DEM for the creation and delineation of watersheds. There is the possibility of burning onto the hydrographic network for better results (Figure 1.B.). The next process is to fill the sinks of the DEM and calculate the flow direction and flow accumulation grids (Winchell et al., 2013). According to the properties of the DEM, SWAT proposes a minimum threshold value which represents the area (in hectares) for the establishment of the drainage area. In this study, the value of 100 hectares was selected and the island of Thasos (entire basin) was divided in 145 smaller sub-basins. Each sub-basin (or watershed) includes a stream (reach), an outlet and the simulated extension of the stream based on the DEM (longest path).

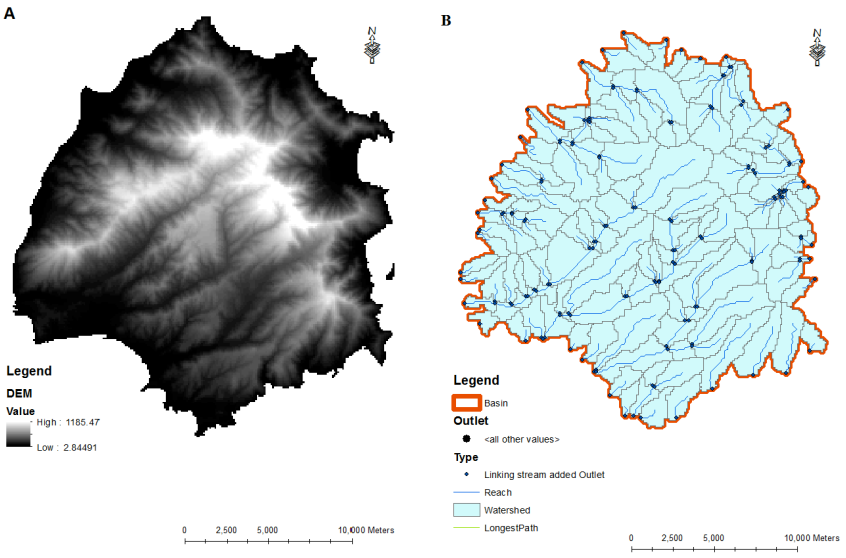

Fig. 1. The study area of Thasos Island*:* **a)** The DEM and **b)** the delineated watersheds.

Most watersheds are typically not homogenous as they consist of different soils and land-uses. As it was mentioned, SWAT can divide the watershed into smaller hydrologic response units (HRU) that are unique combinations of soil type, land cover and slope category (Arnold et al., 2012). SWAT created 2415 HRU considered all soils, land cover types and slope classes. The slope was produced based on the statistics of the DEM and it was divided into five slope classes: i) 0-10 %, ii) 10-20 %, iii) 20-30 %, iv) 30-50 % and v) >50 %.

The soil map was downloaded from the European Soil Portal and the Harmonized World Soil Database Viewer 2012 that had a scale of 1:1,000,000. In addition, the geological map was digitized and the geological parent material was considered and combined in order to create the final soil map (Table 1).

Table 1. The geologic substrate categories of Thasos

Soil Category	Geological Matter	Coverage (%)
1	Transition Zone	42.49
2	Marbles	28.63
3	Gneiss	21.09
4	Sedimentary rocks	7.79

The CORINE 2000 vector files by European Environment Agency were acquired in order to display the land-cover of the island and had a scale of 1:100,000. The land cover of CORINE was reclassified to the categories of land cover that already exist in the SWAT database (Table 2). All of these maps were geo-referenced in the Greek

Geodetic System (D_GGRS_1987). Finally, the weather data were obtained by a meteorological station located in the city of Limenas. The data concerned monthly precipitation and temperature that covered the period from 1975-1997 (Figure 2).

Table 2. The Corine 2000 land cover and the reclassification in the SWAT database.

Code	Corine 2000	Code	SWAT Database	Coverage (%)
112	Discontinuous urban fabric	URML	Urban medium low density	0.57
121	Industrial or commercial units	UCOM	Urban commercial units	0.09
131	Mineral extraction sites	UIDU	Urban industrial units	0.48
211	Non-irrigated arable land	AGRL	Agricultural land Generic	0.06
223	Olives	OLIV	Olives	9.7
243	Land principally occupied by agriculture, with significant areas of natural vegetation.	AGRR	Agricultural land row crops	6.65
311	Broad-leaved forests	FRSD	Forest deciduous	0.25
312	Coniferous forests	FRSE	Forest evergreen	22.33
313	Mixed forests	FRST	Forest mixed	0.16
321	Natural grasslands	PAST	Pastures	17.45
323	Sclerophyllous vegetation	SHRB	Shrubland	
324	Transitional woodland-shrub	SHRB	Shrubland	36.73
331	Beaches, dunes, sand	BARR	Barren areas	0.02
333	Sparsely vegetated areas	BSVG	Barren-sparsely vegetated areas	
334	Burned areas	BSVG	Barren-sparsely vegetated areas	0.49
332	Barren rocks	TUBG	Bare ground	5.02

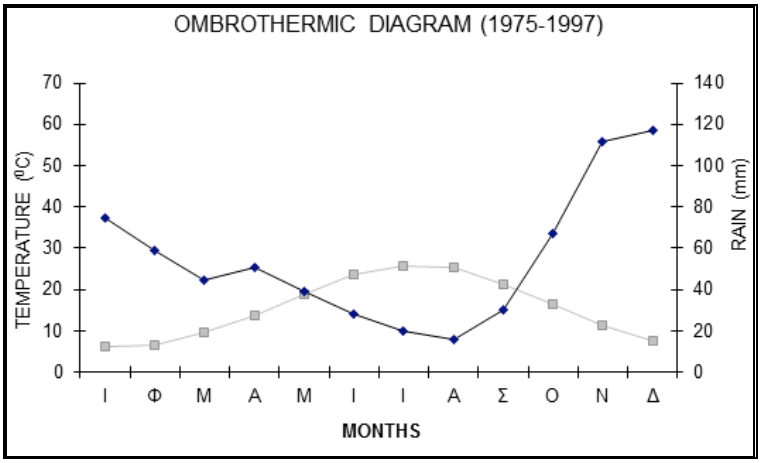

Fig. 2. The ombrothermic diagram of Limenas.

3 Results and Discussion

The simulated outputs were printed in a monthly step. The average precipitation was 844.7 mm. The results showed that most water becomes lateral flow (238.9 mm) through the soil profile because of the highly permeable soils and parent material such as marbles that allow the infiltration. The average surface runoff was about 70 mm and the groundwater flow 63 mm. These three phases consist the total water yield of the area (371.26 mm). The average percolation in aquifers was about 72 mm. There was also a high percentage of evapotranspiration (449 mm) due to the high vegetation of the island.

In addition, a map was produced (Figure 3) that identifies the average simulated stream discharges based on the outputs of SWAT. The depiction is in the view of the sub-basins/watersheds and shows which watersheds discharge had the highest amount of water. Five categories were selected based on the statistics of the flows and specifically they were divided in: i) 0-0.05, ii) 0.05-0.10, iii) 0.10-0.25, iv) 0.25-0.50 and v) 0.50-1.0 (the discharge values are in m^3/sec).

The average monthly water discharge of the major torrent is depicted in figure 4. The upper part of this torrent is situated in central Thasos while its outlet is in southeast region of the island. The specific outlet is also depicted in figure 3 as the left red colored watershed. The simulated results showed that the discharge of the specific torrent ranged between 0.04 to 1.2 m^3/sec. The almost no flow period was noted in the summer period, specifically in July and August, while the highest during November and December.

Main challenges of the study included the lack of important data. Specifically, daily weather inputs were not available, only monthly statistics were used. Observed field discharge data were not available for the calibration of the model. Also, an extensive soil map would be very helpful for the parameterization. Finally, the land cover concerns the 2000 period as Greece has not update the database. Any current satellite images could be helpful for the classification of land cover because Thasos has suffered by many fire disaster during the last 15 years.

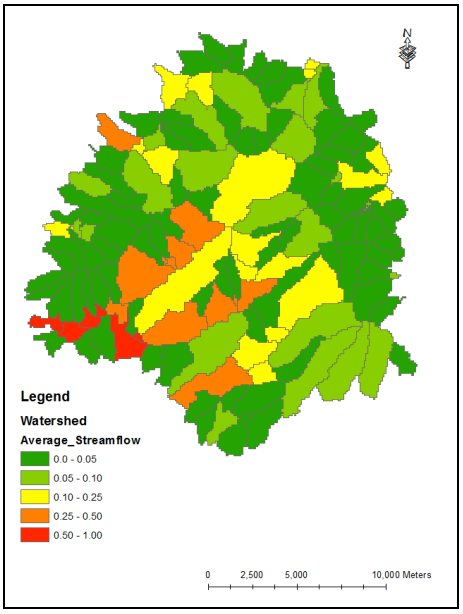

Fig. 3. The average simulated discharges of the watersheds

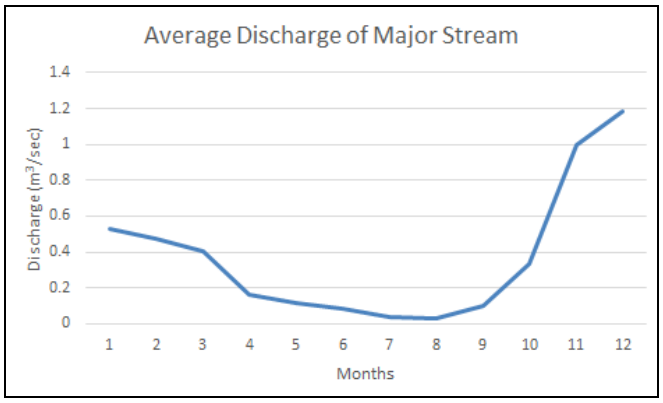

Fig. 4. The average discharge of the major stream

The results could be used for many purposes. The produced map could be a practical guide for water managers and other scientists for water resources management plans. Furthermore, future study could include the implementation of Multi-Criteria Analysis to combine other information such as wildfire maps and road network to identify best locations for water reservoirs to save water resources. The properly managed and stored surface stream water could be utilize for agricultural irrigation, the production hydro-electric power, water supply for municipalities during the summer where problems arise due to tourism and for fire suppression.

4 Conclusions

This study was an attempt to predict the water balance and the stream discharges of Thasos Island. For the specific scope, the hydrologic model SWAT was implemented to simulate the hydrologic conditions. The data used were the topographic map through the DEM, the soil map, the geological map, the land cover map and monthly weather data of the meteorological station located in Limenas. The produced results, maps and hydrographs have some limitation but could be used for water resources management plans and especially to sustainably utilize the surface torrent waters.

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Route Planning For Capacitated Agricultural Machines Based On Ant Colony Algorithms

Kun Zhou[1], Dionysis Bochtis[2]

[1]University of Aarhus, Faculty of Science and Technology, Dept. of Engineering Blichers Allé 20, P.O Box 50, 8830 Tjele, Denmark, e-mail: kun.zhou@eng.au.dk
[2]University of Aarhus, Faculty of Science and Technology, Dept. of Engineering Blichers Allé 20, P.O Box 50, 8830 Tjele, Denmark, e-mail: Dionysis.bochtis@eng.au.dk

Abstract. In agricultural capacitated field operations, i.e. operations where material is transported into the field (e.g. seeding, spraying and fertilizing) or out of the field (harvest), a number of routes are needed for a primary unit to cover the entire field due to its capacity constraint. Hence, the operation of a primary unit must be carefully planned to improve the field operation efficiency. In this paper, an approach for the generation of optimal optimized route to be followed by primary units aimed at reducing the travelled non-working distance is presented. The presented approach consists of two stages. The first stage is about the field geometrical representation where the field is split into parts; the headland area in which the machines can make turns, and field body that is the main cropping area. In geometrical sense, both of them are expressed as a geometrical map using geometrical primitives, such as point, line segment, and polygon. The field body is covered by a set of parallel straight field-work tracks that has two intersections with the field boundary. The second stage is to find the optimal route which is formulated as a capacitated vehicle routing problem (CVRP). It was solved by implementing the ant colony algorithm combined with the Clarke-Wright savings algorithm. A case study is presented based on two fields; the results show that, by using the optimum routing generated, the non-working distance can be reduced in the range of 47.02% - 49.76 %compared with the conventional work pattern.

Keywords: Agricultural machines, field operations, field efficiency, route planning, ant colony algorithm

1 Introduction

Agricultural capacitated operations are field operations that either bring material into the field, such as spraying, planting, and fertilizing, or remove material from the field, such as harvesting. Normally, the machines used for capacitated operations do not have storage capacity for all the material to be brought in to or out from the field, thus the operations involve multiple, co-operating machines. According to the terminology proposed by Bochtis and Sørensen (2009; 2010) , cooperative field operations are executed by one or more primary units (PUs) executing the main task and one or more units (SUs) servicing the PUs. Due to the capacity constrain, the PU

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usually requires several routes, i.e. detours from the field body in order to refill or empty the tank, to fully cover the whole field. Each route consists of three parts, refilling, resuming, and applying in the case of material input operations and emptying, resuming and applying in the case of material output operations. Hence, the operation of a primary unit must be carefully planned to improve the field operation efficiency.

A large amount of papers have been reported for the planning of PUs. These works mainly has focused on two reseedgeh aspects: field geometrical representation and planning within the geometrical representation. The field geometrical representation involves the generation of two types of geometrical entities: field tracks and headland passes using the geometrical primitives (e.g. points, lines, etc.). A number of methods to deal with this problem has been introduced and developed recently (de Bruin et al., 2009; Oksanen and Visala, 2009; Hofstee et al., 2009). The second problem is to find the optimal route or driving direction within the geometrical representation. In relation to this problem, advanced methods based on combinatorial optimization have recently been introduced (Bochtis and Vougioukas, 2008; Bochtis and Sørensen, 2009).

The vehicle routing problem (VRP) is a well-known combinatorial problem, which has been widely used in the industrial sector. Recently, the VRP has been implemented for the planning of infield operations. Bochtis (2008) showed the potential of using VRP for single or multiple machinery systems. Alia et al. (2009) proposed a combination of VRP and minimum cost network flow problem aiming to find the optimal routes for harvesters.

In this paper, a method was developed for capacitated machines, which consists of two stages; the first stage is about the field geometrical representation where the field is split into parts, the headland area in which the machines can make turns, and field body that is the main cropping area. The second stage is to find the optimal route which is formulated as capacitated vehicle routing problem (CVRP). It was solved by implementing the ant colony algorithm combined with the Clarke-Wright savings algorithm.

2 Methods

2.1 Assumption

- Only fields without obstacles are considered, and the field is assumed two-dimensional (flat)
- All traffic in the field body follows straight, parallel tracks.
- A stationary refilling unit (RU) is placed at a certain location in the headland area for support of the PU.
- The application rate is constant.

2.2 Overview

The presented approach is divided into two stages. The first stage regards geometrical field representation, where a field represented by geometrical primitives: such as points, lines and polygons that can be used for operational planning and the specific of the method of generation of geometrical field representation is described in section 1.3. In the second stage, the route planning is formulated as vehicle routing problem (VRP) with the goal to minimize the travelled distance. The details of VRP formulation is shown in section 1.4. A diagram description of the proposed approach is given in the Fig.1.

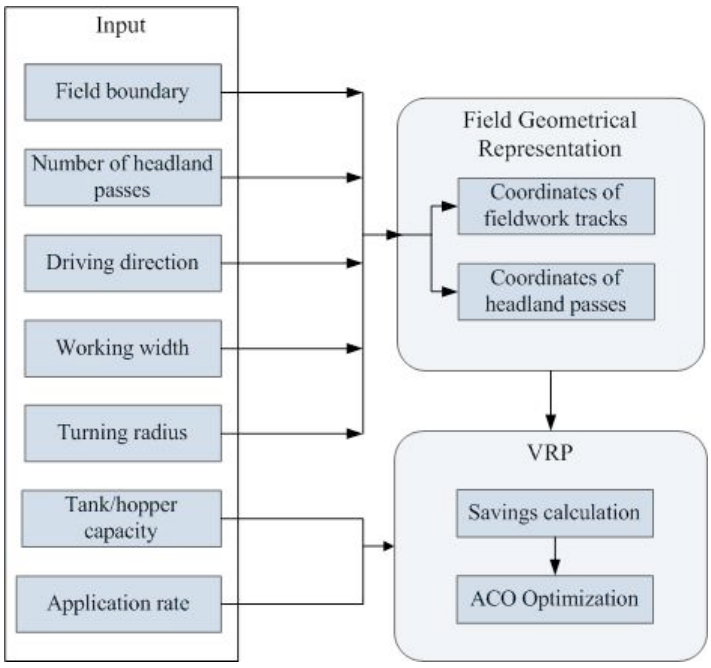

Fig.1. The architecture of the planning method.

2.3 Geometrical representation of the field

The input consists of the set of the coordinates of the field boundary, the operating width of the implement w , the number of headland passes n and the driving direction θ . In the following, this method is introduced in detail.

Headland generation

The field headland area is created by offsetting the boundary inwardly a certain width that equals to the multiplication of the operating width, w times the number of headland passes n. The distance from the field boundaries to the first headland pass is half of the operating width, $w/2$ while the distance between subsequent passes of headland equals to the operating width w. An inner boundary is created at distance $w/2$ from the last headland pass. Fig.2.a shows the headland generation with 2 headland passes.

Track generation

A set of straight tracks parallel to the driving direction θ covering the field body is generated. Each individual track is represented by two end points that are located on the inner field boundary. The distance between subsequent tracks is equal to the operating width w. Let $T = \{1,2,3...n'\}$ be the ordered set of the tracks. An illustrative example of the generated tracks is shown in Fig. 2.b.

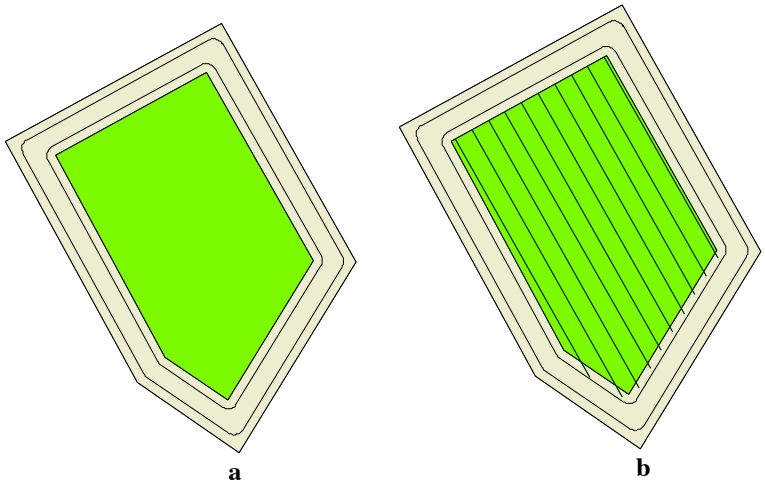

Fig.2. Field geometrical representation: (a) headland generation; (b) track generation.

2.4 Second stage: Vehicle routing problem

Casting agricultural field operation into vehicle routing problem

As mentioned before, the field route planning can be casted as a vehicle routing problem (VRP) which is a well-known combinatorial optimization problem. The VRP consists of determining a set of routes with minimum distance for vehicles

starting and ending at a single depot and satisfying the demand of the customers with the constraints that each customer is served exactly once, and the total demands of the customers in each route do not exceed the capacity of the vehicle. Mathematically, it can be formulated as a weighted graph $G = (V, E)$, where $V = \{0,1,2,...,n\}$ is the set of nodes and E is the set of edges in the graph. The depot is denoted as vertex 0; the remaining node set $V \setminus \{0\}$ is denoted as the customers. For each edge $(i, j) \in E, i \neq j$, a non-negative cost d_{ij} is assigned, representing the transit cost. Each customer $i \in V, i = 1,2,...,n$ is associated with a non-negative demand q_i. A fleet of identical vehicles is available at the depot, each with capacity Q. Let $F = \{f_1, f_2, ...\}$ be the fleet of vehicles. The objective of the VRP is to find a set of minimum cost routes to serve all the customers satisfying following constraints: (i) each customer is visited exactly once by exactly one vehicle, (ii) all routes start and end at the depot, (iii) for each vehicle route, the total demand does not exceed the vehicle capacity Q.

Node demand

In the geometrical field representation, each track is represented by two ending points. The nodes of the VRP correspond to these ends of tracks. The demand of a node is set as half of corresponding total demand of a track. For material input operation as well as the material output operation, the demand of a node represents the quantity of material that need to be distributed or picked up from the field area.

Edge cost assignment

There are three types of edges between each pair of the nodes, namely: edges connecting RU and track ends, edges connecting pairs of nodes that represent two ends of two respective tracks, called headland turnings. And the edge cost for connecting both ends at same track

For the first type of edge, the edge cost is the travelled distance between track ends and depot along the headland path. In the case where two nodes represent the two ends of one track, the connection between these two nodes has to be enforced. In other words, once a vehicle selects one end as the track entry, the vehicle has to finish the operation on the current track, namely exits at the opposite end of the current track before moving to another track. Therefore, for these nodes, the edge cost is set as zero. While the edge cost of the third type is determined by the distance corresponding the headland turning travelled by the vehicle from the exit point of current track to the entry point of the next selected track. To meet practices, when the tractor drives from one track to another it drives along one of the headlands paths, which headland path can be specified in the algorithm. From each end of a track it is usually possible to turn either left or right to exit the track, then along the headland pass to enter the next track. The distance for travelling from one track to another is calculated as the turn distance to exit the track plus the distance along the headland plus the turn to enter the next track. Fig. 3 shows the edge connection.

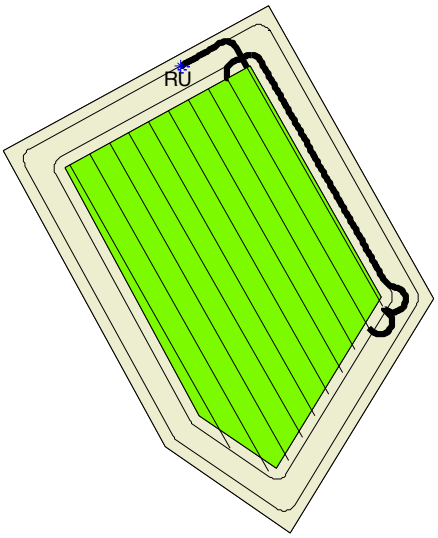

Fig. 3. (a),(b) edge connection between endings of tracks; (c) edge connection between ending of track and RU's location.

Optimization algorithm

The VRP belongs to the class of NP-hard problems, as the size of the problem increases, it turns out be harder and harder to obtain an exact solution in a reasonable time. Recently, the focus of research towards this problem was on using meta-heuristics, such as Tabu research, Genetic research, and ant colony system.

In this paper, we focus on ant colony algorithm (ACO) to solve the VRP, which is a mathematical model of ants behavior in finding the shortest route between colonies and food. The principle is based on that every ant deposits the pheromone on the passed path. However, the pheromone starts to evaporate over time, thus reducing its attractive strength. A short route is passed frequently by ants, and thus the pheromone density on shorter paths is higher than longer ones', consequently, the shortest route has the highest pheromone density (Dorigo, 1996).

. It mainly consists of three steps in each iteration:

- Construction of vehicle routes by ants based on the pheromone information;
- Application of local research to improve the routes;
- Pheromone information update.

Construction of vehicle routes

The way of ant constructing the vehicle routes is as follows: firstly, all the artificial ants are placed at the depot, then successively choose the customer to visit, until all the customers have been visited, whenever the selection of the next customer violates the rule that total demand of current visited customer exceed the vehicle capacity, then a new route will be started from the depot again. At each construction step, an ant k at current node i to choose the next city j from a feasible set of customers according to Eq.1:

$$p_{ij} = \frac{[\tau_{ij}]^{\alpha}[\eta_{ij}]^{\beta}\left[\mu_{ij}\right]^{\gamma}}{\sum_{\lambda \in \Omega}[\tau_{i\lambda}]^{\alpha}[\eta_{i\lambda}]^{\beta}\left[\mu_{i\lambda}\right]^{\gamma}}, if \ \ j \in \Omega$$

,

Where $\Omega = \{j \in V \setminus visited \ \ nodes\}$, τ_{ij} denotes the pheromone concentration on the edge (i, j), which is used to describe how good was the selection of customer j in previous iterations ,η_{ij} representing how promising is the selection of customer j from current customer i , and μ_{ij} is the savings of combining two customers i and customer j on one route against visiting them on separate routes.

Specifically, for calculation the savings for each pair of nodes, the following rule is used.

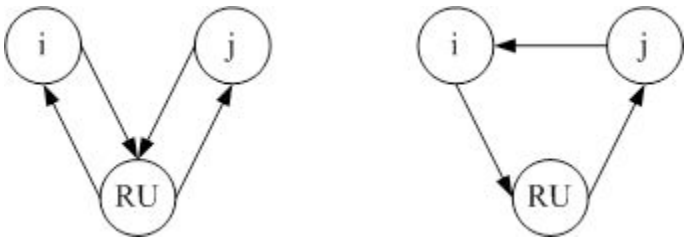

Fig.4. savings calculation: a long route (a) that visits two nodes separately; a shorter route (b) that visits two nodes before returning to the RU.

(1) Cost(LongRoute) = cost(RUToNodei) + cost(NodeiToRU) + cost(RUToNodej) + cost(NodejToRU)
(2) Cost(ShortRoute) = cost(RUToNodej) + cost(NodejToNodei) + cost(NodeiToRU)
(3) Saving = Cost(LongRoute) - Cost(ShortRoute)

Local search

After the ants have constructed their respective routes, each ant's routes are improved by a local search. In this paper, the 2-opt heuristic was used. The 2-opt algorithm iteratively modifies the current generated route by removing two edges then two new edges used to reconnect the route until no further improvements are possible. Details of the 2-opt can be found in CROES (1958).

Pheromone update

After the solution construction by all the ants, the pheromone trails are updated according to solutions found by the ants. Here the rank based scheme proposed in Bullnheimer et al. (1998) is used, in which only the best ranked ants (also called elitist ants) are used to update the pheromone trails where the rank is according to the solution quality. The pheromone updated is done as follows:

$$\tau_{ij}^{'new} = \rho\tau_{ij}^{old} + \sum_{k=1}^{\sigma-1}\Delta\tau_{ij}^{a} + \sigma\Delta\tau_{ij}^{*}, \qquad (2)$$

Where ρ is the trail persistence ($0 < \rho < 1$), thus the trail evaporation is given by $1-\rho$. There are two types of pheromone trails that are deposited. First, the best solution found is updated as if σ ants had visited it. The quantity of pheromone deposited by the elitists is $\Delta\tau_{ij}^{*} = 1/L^{*}$, where L^{*} the objective value of the best solution found so far is. Second, the only the $\sigma-1$ best ants are allowed to deposit pheromone on the edge they has traversed, the quantity of pheromone deposited by theses ants depends on their rank k and the solution quality L^{k}. For instance, the k_{th} best ant deposits $\Delta\tau_{ij}^{k} = (\sigma-k)/L^{k}$. However, edges that do not belong to those solutions evaporate their pheromone at the rate $(1-\rho)$.

3 Results and Discussions

The case study was based on two fields (referred as to field A, B in Fig.5) located in research Centre Foulum. Denmark. The field A has an area of 3.3 ha, while field B has an area of 4.1 ha. The operations involved are slurry applications which consist of an application unit (AU) with tank size of 30 m3 and a stationary refilling unit (RU) with tank size of 45 m3. The application rate for the distribution of Nitrogen is 0.0043 m3/m2, the operating width of the AU is 9 m and the turning radius is 6 m. For both fields, the number of the headland passes is set to be 2. In order to investigate the benefits of the optimized route by the model, the conventional strategy as described by Dionysis (2009) is used. For finding the shortest connection distance of blocks, parameters of the ACO algorithm were set as : $\rho = 0.5, \alpha = 1$, $\beta = 5$ and $\sigma = 6$, and the number of iteration was 300. The number of the ants used was equals to the number of the nodes (track endings).

A B

Fig. 5. Case study fields

The optimized route generated by the developed method for field A is RU-> 27-> 28-> 24-> 23-> 19-> 20-> 16-> 15-> RU-> 11-> 12-> 8-> 7-> 3-> 4-> 2-> 1-> 5-> 6-> 10-> 9-> 13-> 14-> 18-> 17-> RU->21-> 22-> 26-> 25-> 29 ->30. The total non-working distance (including the turning, transport distance) is 662.4 m, while when using the conventional coverage strategy, the total non-working distance is 1250.4 m.

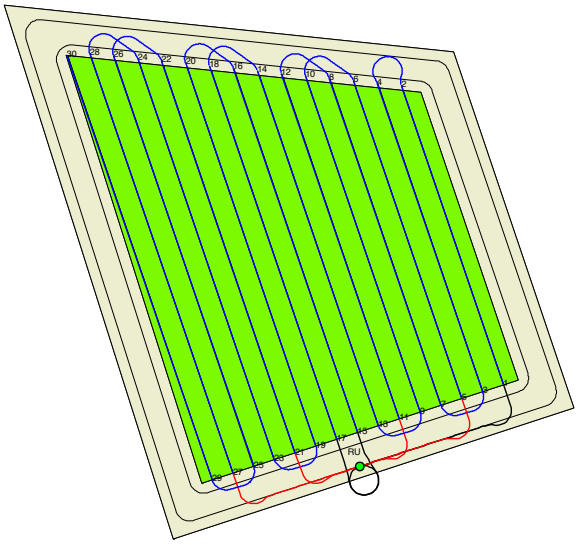

Fig.6. The generated routes for field A by the model.

The optimized route generated by the developed method for field A is RU-> 1 -> 2 -> 6 -> 5-> 9-> 10 -> 14-> 13-> RU-> 17-> 18-> 22-> 21-> 25-> 26-> 24-> 23 -> 19-> 20-> 16 -> 15 -> RU-> 11->12-> 8 ->7-> 3->4. The total non-

working distance (including the turning, transport distance) is 500.43 m, while when using the conventional coverage strategy, the total non-working distance is 996 m.

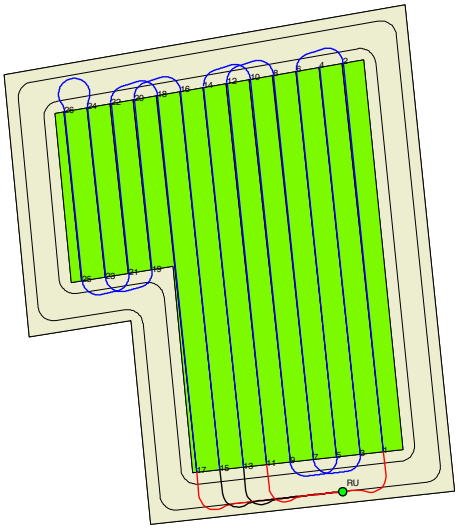

Fig. 7. The generated routes for field B by the model.

4 Conclusion

In capacitated operation, a number of routes are required for a primary unit to cover a normal size field. In this paper, an approach for the generation of optimal route for primary units aimed at reducing the non-working distance travelled is presented. The proposed approach consists of two stages, the first stage is field geometrical representation, and the second stage is to find the optimal route which is formulated as capacitated vehicle routing problem (VRP). The VRP problem is solved by ant colony algorithm.

To demonstrate the developed method, two fields were used for case study. The results show that the developed method can provide optimized solution in terms of non-working distance, subsequently non-productive time. The reduced non-working distance can reach 47.02%, 49.76 % in field A, field B, respectively.

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Main Features and Application of a Web-based Irrigation Management Tool for the Plain of Arta

Nikolaos Malamos[1], Ioannis L. Tsirogiannis[2], Antonis Christofides[3], Stavros Anastasiadis[4], Silvia Vanino[5]

[1]Technological Educational Institute of Western Greece, Dept. of Agricultural Technology, 27200 Amaliada, Greece, e-mail: nmalamos@teimes.gr
[2]Technological Educational Institute of Epirus, Dept. of Agricultural Technology, 47100 Kostakii, Arta, Greece, e-mail: itsirog@teiep.gr
[3]National Technical University of Athens, Dept. of Water Resources and Environmental Engineering, Iroon Politechniou 5, 15780 Zografou, Athens, Greece, e-mail: anthony@itia.ntua.gr
[4]Chios, Greece, e-mail: anastasiadis.st00@gmail.com
[5]Consiglio per la Ricerca in Agricoltura e l'Analisi dell'Economia Agraria, 41 Nomentana St., 00161, Rome, Italy, e-mail: vanino@inea.it

Abstract. Agriculture plays a key role in the management of water use. Especially in Greece, irrigation is an essential element of agricultural production and agricultural water use has a substantial share in total water use. The presented study illustrates the key features of the IRMA_SYSTEM, a regional, user-friendly computer/mobile-based, open and free modular software for estimating site specific crop water requirements and irrigation scheduling at multiple scales, from farm to water basin level. The estimation of irrigation water requirements and irrigation scheduling is based on a modification of the FAO 56 approach. The system takes into account historical and forecast agrometeorological data, along with crop and soil-water data to accomplish its tasks. Also, it is fully customizable, allowing the users to add site and crop specific information taking advantage of additional data. Feedback and evaluation procedures are already applied and expected to contribute to the improvement of the system.

Keywords: irrigation scheduling, open source software, agrometeorological information

1 Introduction

According to the EU Water Framework Directive WFD, 2000/60/EC (EU, 2000 (Greek law (GL) 3199; Govern. Gazette (GG) A'280 9-12-2003) and Presidential Decree (PD) 51;GG A΄54 8-3-2007)), action is needed to protect waters primary in qualitative but also in quantitative terms. In the framework of the UN Environment Program (UNEP, 2005) it was concluded that a challenge of water-related issues for Mediterranean countries is to integrate water demand management in agriculture and

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to develop added value tools to optimize efficiency in irrigation. In 2012, the EU-report on identifying water saving potentials in the EU countries mentioned that improving water application efficiency would save 15 to 60% of water use (BIO Intelligent Service, 2012). Also CMMC (2013) predicts a reduction up to 60% in water availability for irrigation in extended Mediterranean areas of EU countries. These facts make optimum irrigation water management a top priority goal. Beyond these, the European Landscape Convention (which was adopted by the Greek state in 2010, GL 3827;GG A'30 25-2-2010) promotes protection, management and planning of natural, rural, urban and peri-urban areas including land, inland water and marine areas and must be also taken into account as an integral part of the environmental and agricultural legislative framework. Among the various measures which member states are proposed to adopt and develop are added value tools to optimize efficiency in irrigation.

The purpose of the present study is to illustrate the key features of such a tool, the IRMA_SYSTEM (http://arta.irrigation-management.eu/), which is a regional, user-friendly computer/mobile-based, open and free modular software for estimating site specific crop water requirements and irrigation scheduling at multiple scales, from farm to water basin level, with high spatial resolution. The system takes into account historical (from the system's stations) and forecast agrometeorological data, along with crop and soil-water data to accomplish the above mentioned tasks. Also, it is fully customizable, allowing the users to add site specific information in order to customize the output of the system, taking advantage of additional information.

Similar systems are: the California Irrigation Management Information System (CIMIS, http://wwwcimis.water.ca.gov/), the Hydrotech-DSS (Todorovic et al. 2013) and the ServiziAgronomici e Fitosanitari, Consiglio Irriquo (http://www.agrometeopuglia.it) (AssocodiPuglia, 2008).

2 Materials and Methods

2.1 Study Area

The Region of Epirus (hydrological area GR05; Fig. 1) is located at the North-West part of Greece, it has a total area of 9.203km^2 (agricultural land corresponds to the 14% of it) and a population of 353.820 p. The plain of Arta (45.329 ha, the biggest of the region), is located at the south edge of Epirus, it is part of the Aracthos and Louros hydrological basins (GR14 and GR46; WFD, 2013) and intersects with Amvrakikos Wetlands National Park.

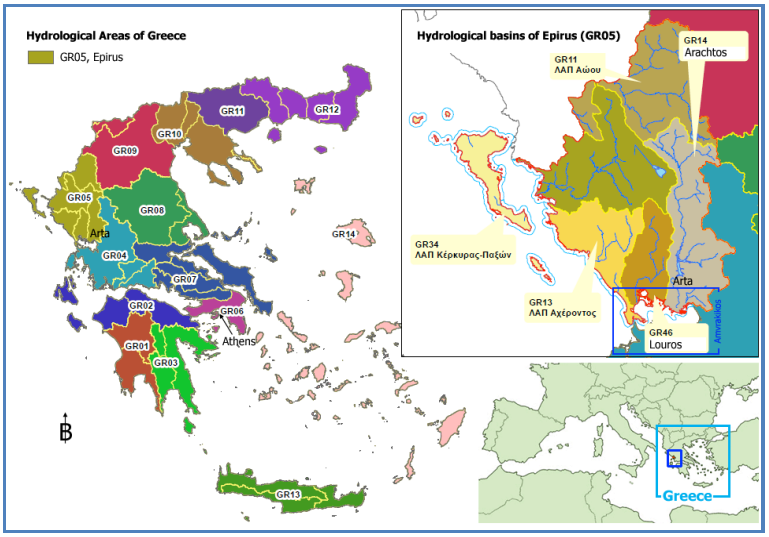


Fig. 1. Hydrological basins of Greece, along with the hydrological basins of Epirus. (WFD, 2013)

2.2 Estimation of daily and hourly potential evapotranspiration, with the Penman - Monteith equation

The Penman - Monteith (PM) equation for the estimation of reference evapotranspiration was developed to describe potential evapotranspiration (PET) of a reference grass crop, which is defined as the rate of evapotranspiration from a hypothetical crop with an assumed fixed height (12 cm), surface resistance (70 sm^{-1}) and albedo (0.23), closely resembling the evapotranspiration from an extensive surface of a disease free green grass cover of uniform height, actively growing, completely shading the ground, and with adequate water and nutrient supply (Allen et al., 1998, Eq. 1). To ensure the integrity of computations, the weather measurements should be made at 2 m (or converted to that height) above an extensive surface of green grass, shading the ground and not short of water. Standard methods are proposed by Allen et al. (1998) to compute the parameters of Eq. 1 from the observed climatic variables.

$$PET = \frac{0{,}408\Delta(R_n - G) + \gamma \frac{900}{T+273} u_2 (e_s - e_a)}{\Delta + \gamma(1 + 0{,}34u_2)} \quad (1)$$

where PET is the grass reference evapotranspiration (mm day^{-1}), R_n is the net radiation at the crop surface (MJ m^{-2} day^{-1}), G is soil heat flux density (MJ m^{-2} day^{-1}), T is mean daily air temperature at 2m height (ºC), u_2 is wind speed at 2 m height (m s^{-1}), e_s is saturation vapor pressure (kPa), e_a is actual vapor pressure (kPa), e_s–e_a is

saturation vapor pressure deficit (kPa), Δ is slope of the vapor pressure curve (kPa C^{-1}), and γ is psychometric constant (kPa C^{-1}). This equation uses standard meteorological records of solar radiation (net, short wave, or sunshine duration) or sunshine duration, minimum and maximum air temperature, air humidity (preferably minimum and maximum relative humidity) or wet and dry bulb temperature, and wind speed.

In areas where substantial changes in wind speed, dew point or cloudiness occur during the day, calculation of the PET equation using hourly time steps is generally better than using 24-hour calculation time steps. Such weather changes can cause 24-hour means to misrepresent evaporative power of the environment during parts of the day and may introduce error into the calculations. With the use of the IRMA_SYSTEM, automated weather stations, weather data are available for hourly periods. Therefore, the PM equation was applied on an hourly basis (Allen et al., 1998).

2.3 Estimation of irrigation needs

The irrigation needs are estimated based on an approach that is called root zone soil water depletion, which is a simplified soil water balance based on an initial soil moisture condition and runs for a specified time period (*start date*, *end date*).

The basis for the calculation is the following ormula (Allen et al., 1998):

$$D_{r,i} = D_{r,i-1} - (P_i - RO_i) - IR_{n,i} - CR_i + ET_{c,i} + DP_i \quad (2)$$

where: i is the current time period (i.e. the current day, or hour), $D_{r,i}$ is the root zone depletion at the end of the previous time period, P_i is the precipitation, RO_i is the runoff, $IR_{n,i}$ is the net irrigation depth, CR_i is the capillary rise, $ET_{c,i}$ is the crop evapotranspiration, DP_i is the water loss through deep percolation.

The following limits were imposed on $D_{r,i}$:

$$\Theta_s <= D_{r,i} <= ASM \quad (3)$$

where Θ_s is the soil moisture at saturation and ASM is the total available soil water, which is the difference between Field Capacity (FC) and Permanent Wilting Point (PWP) as they are presented in Fig. 2. This approach is slightly different that the one proposed by Allen et al., 1998, since they propose that $D_{r,i}$ is always positive.

RO_i equals the amount of water that exceeds soil moisture at saturation after heavy rain, i.e.:

$$RO_i = P_i + \Theta_{i-1} - \Theta_s \text{ when } (P_i + \Theta_{i-1} - \Theta_s) > 0 \quad (4)$$

where Θ_{i-1} is the soil moisture at the previous time step. CR_i and DP_i are considered zero, since in the case of the Arta plain there is a shallow water table and equilibrium between them is considered.

The equation therefore becomes:

$$D_{r,i} = D_{r,i-1} - P_i - IR_{n,i} + ET_{c,i} + RO_i \quad (5)$$

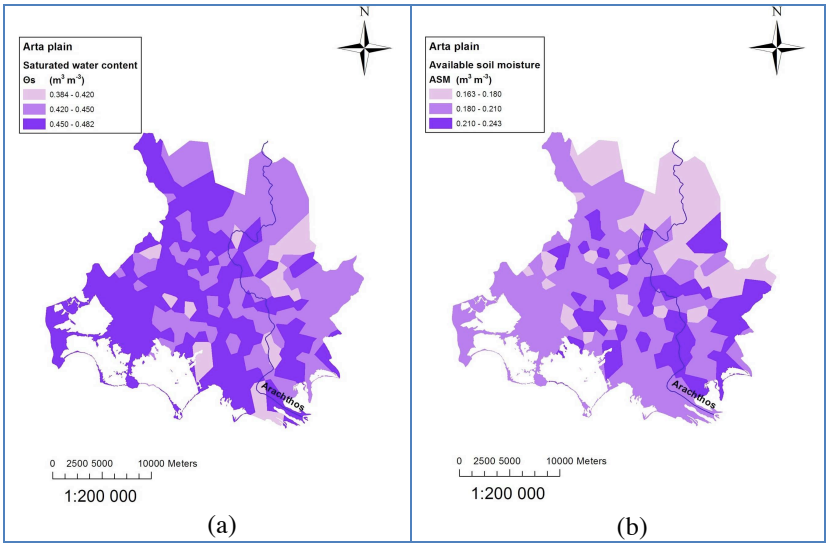


Fig. 2. Saturated water content (Θs) map (a) and Available soil moisture (ASM) map (b) of IRMA_SYSTEM area at Arta plain.

$ET_{c,i}$ is calculated using crop coefficient approach by multiplying evapotranspiration by crop coefficient Kc (Allen et al., 1998).

Each time the user irrigates, the initial depletion derives from the provided irrigation water volume. An essential simplifying assumption of this method is that each time we irrigate without providing the irrigation water volume, we assume that enough water was applied in order for the soil moisture to reach FC (i.e. zero depletion). Therefore, in this case we have i=1 and $D_{r,1}=0$.

The point i=1 is specified by *start_date*, which is a datetime object. The *initial_soil_moisture* will usually equal FC (this, according to the essential simplifying assumption, means that the crop was irrigated on *start_date*). However, if the crop has not been irrigated recently, *initial_soil_moisture* will be set to another value (such as a soil moisture measurement made at *start_date*).

Soil moisture (Θ_i) and depletion are related with this formula:

$$\Theta_i = \text{FC} - D_{r,i} / \text{Root depth} \quad (6)$$

So, since the *initial_soil_moisture* is given, $D_{r,1}$ is also known.

The method returns the root zone depletion for *end_date* in millimeters (mm). Precipitation and ET_c must have non-null records for all days from the day following *start_date* to *end_date*.

2.4 System Implementation

The system is a product of cooperation between experts in the fields of meteorological data acquisition, agricultural cultivation and landscapes water needs,

irrigation management, irrigation controllers manufacturing and software developers. The general organisation of the system is presented in Fig. 3, while the flowchart of the system modules is presented in Fig. 4.

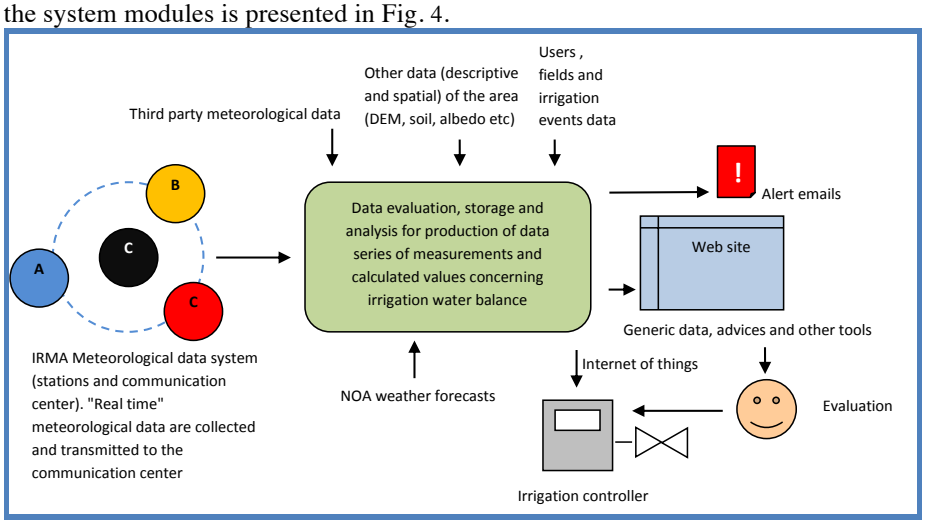


Fig. 3. IRMA_SYSTEM organisation plan

The IRMA_SYSTEM is a user-friendly computer/mobile-based, open and free modular software, with its source available at: https://github.com/openmeteo/aira, under the terms of the GNU General Public License as published by the Free Software Foundation, written in Python and Django, along with NumPy (http://www.numpy.org/) and GDAL - Geospatial Data Abstraction Library (http://www.gdal.org/) modules.

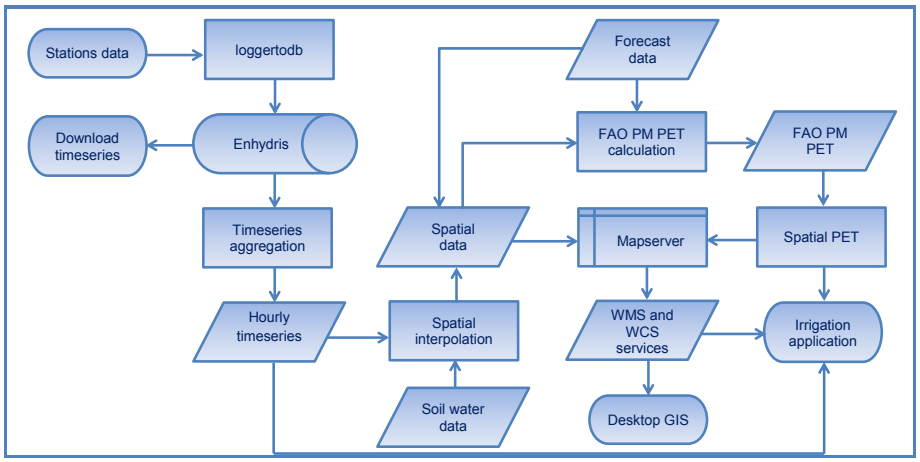


Fig. 4 Flowchart of IRMA system modules

The Enhydris database (http://system.irrigation-management.eu, https://enhydris.readthedocs.org) web interface, with the available meteorological stations is presented in Fig. 5. It includes a map that provides information about the location of each station, together with the identification numbers, water basin, water division, owner and type of the meteorological stations.

Agrometeorological data timeseries and crop water requirements estimations are provided to users and visitors, while irrigation advices and a series of other utilities will be available only to registered users. Users that want more precise results will have to install meteorological and/or soil moisture sensors and dataloggers at their fields.

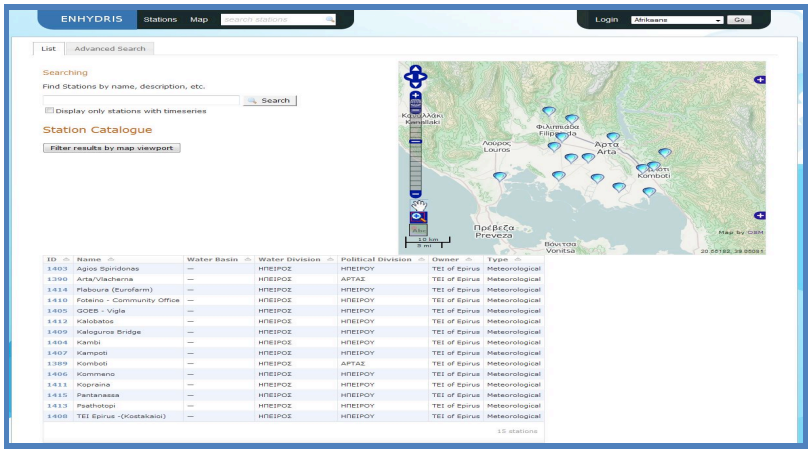


Fig. 5. The Enhydris database web interface

Agriculturalists, green infrastructure managers, farmers and gardeners will be able to use the system for setting up irrigation schedules, plan and record irrigation events as well as self-training regarding irrigation management.

Figure 6 presents the home page of the system. The main feature is the map presentation of the different variables, in daily time scale, that are involved in the irrigation requirements methodology presented above, such as: Rainfall, Potential Evapotranspiration, Humidity, Temperature, Wind speed and Solar Radiation, with high spatial resolution of 70×70 m grid. The maps are produced by implementing the Inverse Distance Weighting (Burrough and McDonnell, 1998) method for spatial interpolation, found in the GDAL library.

The system provides this information of the study area, through the WMS service provided by the Mapserver that was set for the purposes of the present project (http://mapserver.org/). The historical data are kept from 1/1/2015 onwards, while several maps produced by satellite images are also available.

Registered users can add their fields into the system (Fig. 7) using a map, in order to pinpoint the geographic location of each field, with the help of the Hellenic Cadaster orthophoto imagery basemap (http://gis.ktimanet.gr/wms/ktbasemap) that allows zoom in scales up to 1 m. The user should provide information regarding the

field's area, crop, irrigation type and strategy. Also, a list of the user's already register fields is available at the bottom of the page.

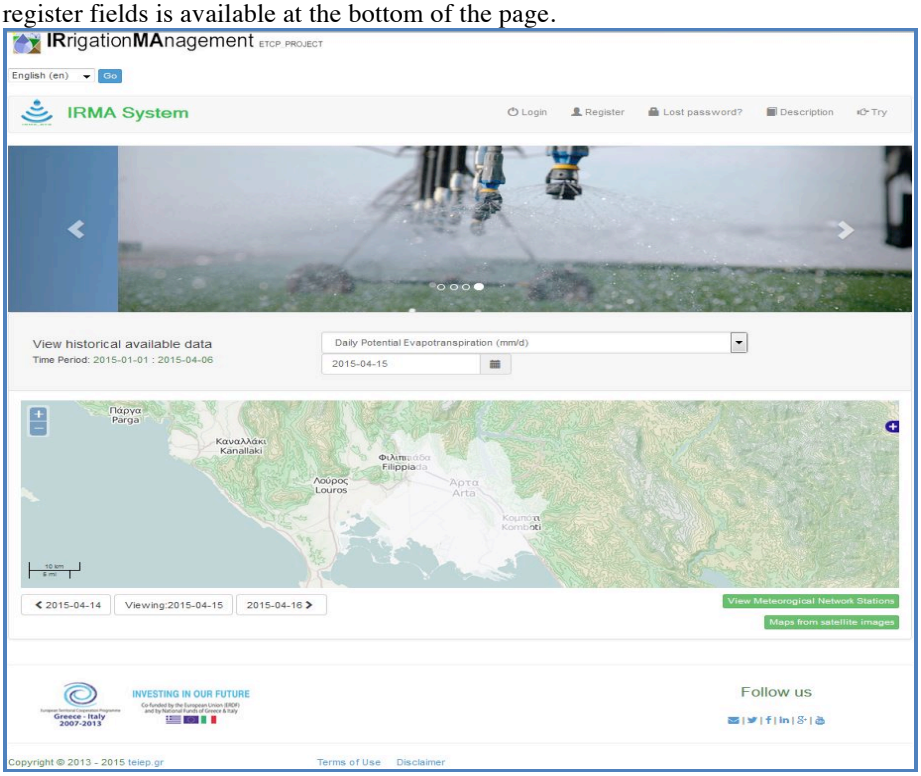


Fig. 6. IRMA_SYSTEM front page

If appropriate information is available to the registered users, they are able to modify the properties of each field, based on this information, as shown in Fig. 7. This information consists of parameters grouped in three major categories:

- Irrigation Management
- Crop Parameters
- Soil Parameters

Irrigation Management includes information regarding irrigation efficiency and strategy. Crop includes information regarding the crop coefficient (Kc), the maximum allowed depletion factor (MAD), the estimated maximum and minimum root depth. Soil includes information regarding the FC, PWP and Θ_s. Appropriate ranges and the system's default values, according to literature, are available to the user in order to provide guidance.

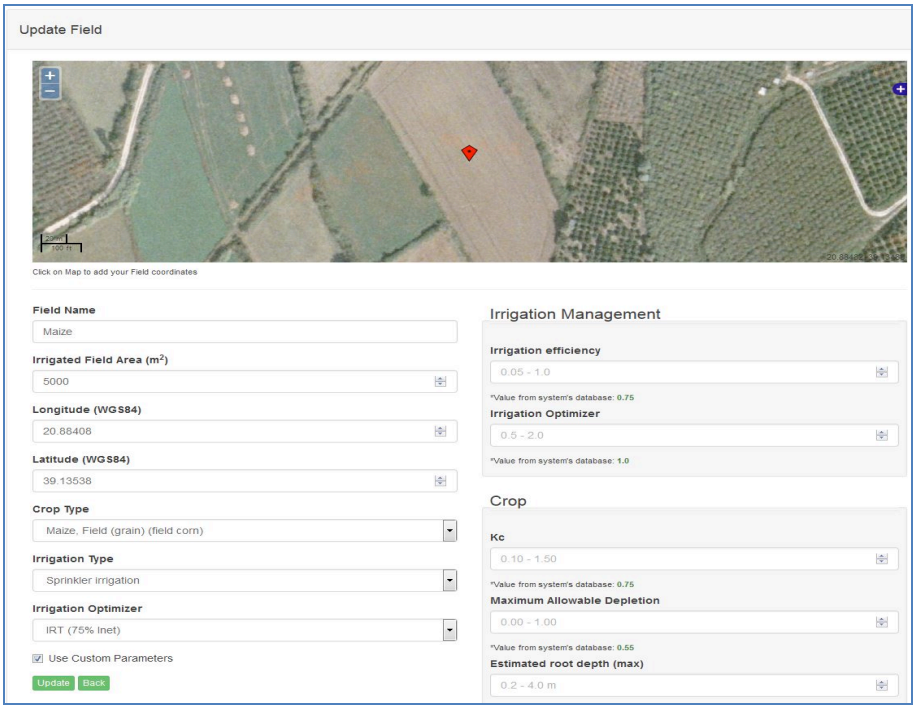


Fig. 7. The Update Field module of the IRMA_SYSTEM

Since the initial soil moisture is included in the initial conditions of the soil water balance module of the IRMA_SYSTEM, register users should add the irrigations that they have applied for each field, in order to get the appropriate irrigation advices. If the user does not provide information about the applied irrigation water volume, the system assumes that the applied water was enough in order for the soil to reach field capacity. Figure 8 depicts the irrigation events list module of the IRMA_SYSTEM.

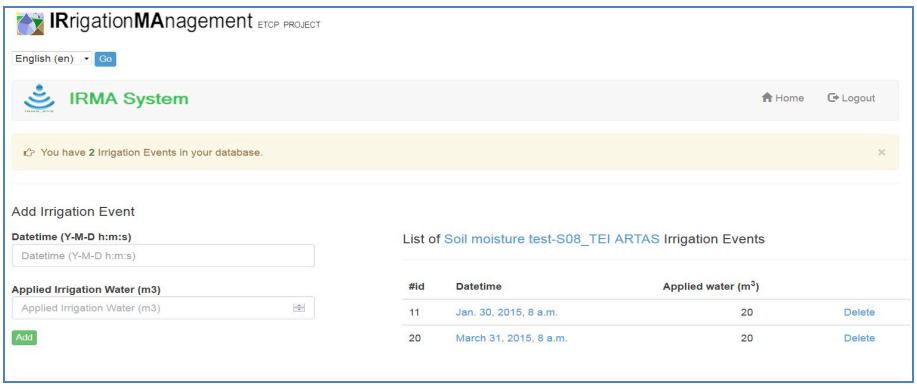


Fig. 8. The Irrigation Events list module of the IRMA_SYSTEM

Since the registered users provide the above information, the system produces detailed irrigation advice estimates, in hourly basis, based on both historical and forecast data as presented in Figures 9, 10.

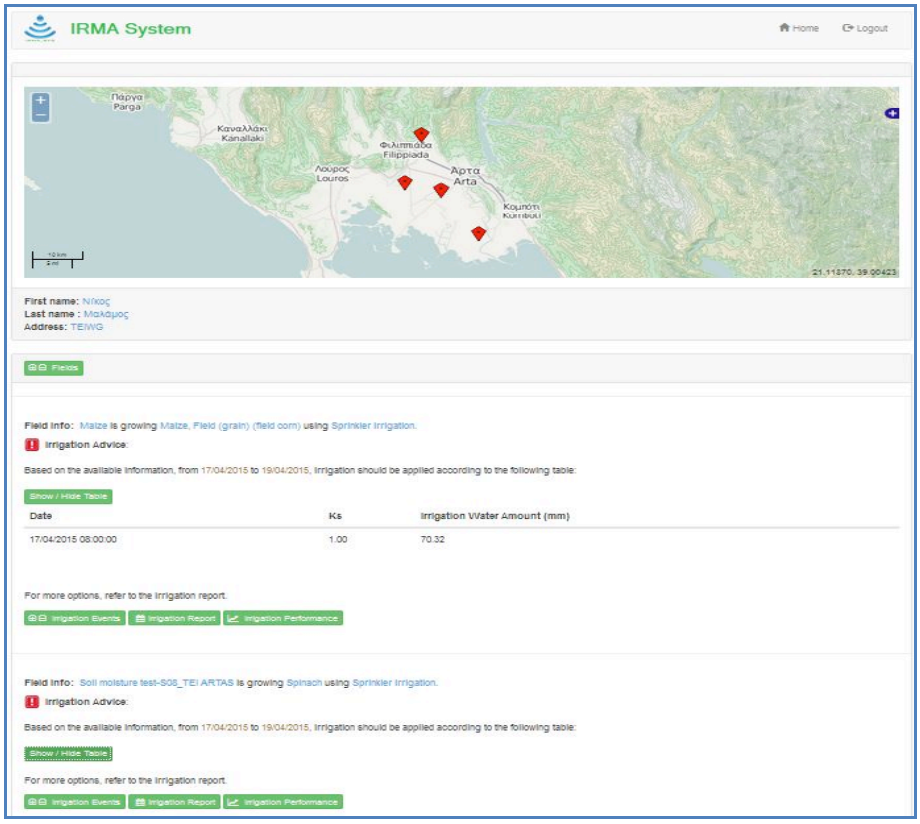
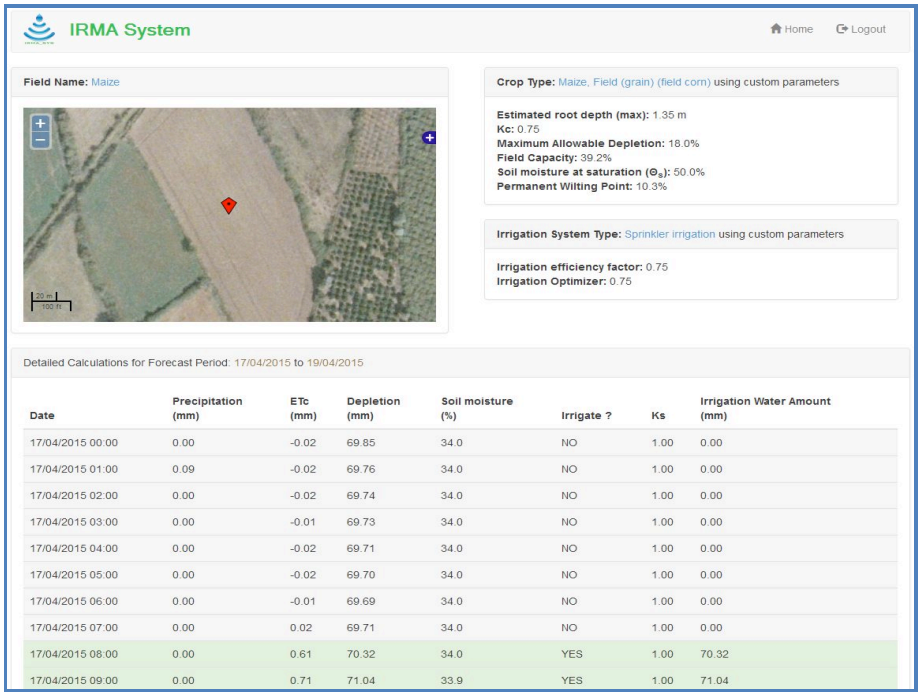


Fig. 9. Irrigation advice module of the IRMA_SYSTEM

2.5 Evaluation and Feedback

A feedback procedure will be available for users that want to contribute to the improvement and evolution of the system by evaluating it. A series of training seminars for agriculturalists, which are expected to be the main type of users (in order to analyze the provided information before make relevant suggestions to farmers and green spaces managers) will follow the development. Also special seminars for end users, in order to have a basic understanding of the system operation will be made. Relevant training and help material will be available at the tool's web site.

Field evaluation will be held for both agriculture and landscaping case studies, against soil moisture readings from installed sensors at the agrometeorological stations and irrigation water amount recordings.



Date	Precipitation (mm)	ETc (mm)	Depletion (mm)	Soil moisture (%)	Irrigate ?	Ks	Irrigation Water Amount (mm)
17/04/2015 00:00	0.00	-0.02	69.85	34.0	NO	1.00	0.00
17/04/2015 01:00	0.09	-0.02	69.76	34.0	NO	1.00	0.00
17/04/2015 02:00	0.00	-0.02	69.74	34.0	NO	1.00	0.00
17/04/2015 03:00	0.00	-0.01	69.73	34.0	NO	1.00	0.00
17/04/2015 04:00	0.00	-0.02	69.71	34.0	NO	1.00	0.00
17/04/2015 05:00	0.00	-0.02	69.70	34.0	NO	1.00	0.00
17/04/2015 06:00	0.00	-0.01	69.69	34.0	NO	1.00	0.00
17/04/2015 07:00	0.00	0.02	69.71	34.0	NO	1.00	0.00
17/04/2015 08:00	0.00	0.61	70.32	34.0	YES	1.00	70.32
17/04/2015 09:00	0.00	0.71	71.04	33.9	YES	1.00	71.04

Fig. 10. Detailed irrigation report module of the IRMA_SYSTEM.

3 Conclusions

The IRMA_SYSTEM is an added value regional management and planning tool designed to contribute along with the other tools of IRMA project (http://www.irrigation-management.eu/) to the improvement of efficiency in irrigation techniques and irrigation scheduling from farm to water basin level, with high spatial resolution.

It is a user-friendly computer/mobile-based, open and free modular software that provides crop water requirements estimations and irrigation advices to users and visitors, based on agrometeorological data timeseries and a modified FAO 56 approach.

The system is fully customizable, allowing the users to add site and crop specific information in order to customize the output of the system, taking advantage of additional information.

It is easily expandable, since the individual modules are independent of the number of stations and accepts all kinds of forecast data.

The feedback and experimental evaluation procedures will contribute to the further improvement and versatility of the system, aiming at increased experience gain at regional level with different type of farms, crops and soil water information.

Acknowledgments. This work has been co-financed by EU / ERDF (75%) and national funds of Greece and Italy (25%) in the framework of the European Territorial Cooperation Programme (ETCP) GREECE-ITALY 2007-2013 (www.greece-italy.eu): IRMA project (www.irrigation-management.eu), subsidy contract no: I3.11.06.

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Importance of Water in Morphology

Yasemin Leventeli[1]

[1]Akdeniz University, Geological Engineering Department, Antalya, Turkey

Abstract. Numerous huge landslides and a lot of springs are located in Ecemiş Fault Zone between Adana and Niğde, in the south of Turkey. The water-discontinuity-clay trinity plays a significant role in the formation of these landslides and morphology of the area. A large-scale dam and a highway were planned in this valley where is highly rich in terms of flora and fauna and composed by huge slopes. This study showed that the water in the area is meteoric and one of the main cause of landslides. Any big project can cause many geotechnical problems with remedial works. Because, the safety coefficient of huge landslides is 1 which means their stability is critical and any operation will disrupt this balance. Because of this and/or similar geotechnical problems; the projects were canceled. Besides, water is potable and suitable for irrigation and the valley stands as national wealth.

Keywords: Ecemiş, fault, landslide, water.

1 Introduction

The study area is located on Ecemiş Fault Zone; between Pozantı, district of Adana and Bademdere, district of Niğde with 0.5 - 5 km wide and about 60 km long (Figure 1). The trinity water-discontinuity-clay (WDC) is the main cause of geotechnical problems in the zone; especially huge landslides with several billions cubic meters have been formed by this trinity.

The aims of this study are to reveal the role of water in the formation of landslides by identifying the origin of water and to understand the geochemical properties of it.

Proceedings of the 7th International Conference on Information and Communication Technologies in Agriculture, Food and Environment (HAICTA 2015), Kavala, Greece, 17-20 September, 2015.

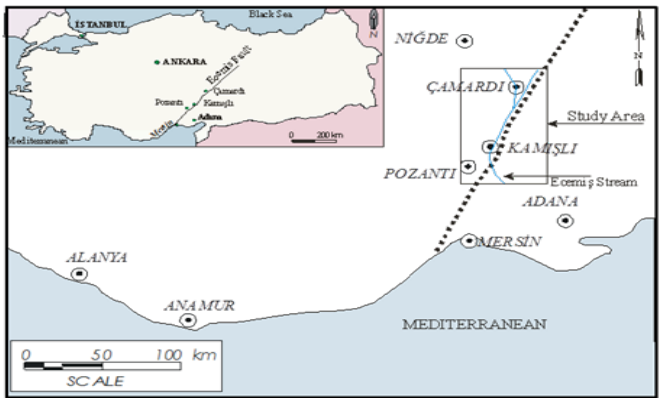

Fig. 1. Location map of study area.

2 Materials and Methods

2.1 Materials

The study area is a hallway with about 60 km long and 0.5 - 5 km width between Adana and Niğde, is located in Ecemiş Fault Zone which is one of the important tectonic places in Turkey (Figure 2). The zone was formed between Paleocene and Lutetian. The main fault has a direction with N20E, left-lateral, vertical strike-slip. The second major fault in the study area is Cevizlik Fault which is more or less parallel to the Ecemiş Fault.

Numerous sources and ponds were created in the study area, along Ecemiş Fault Zone. Three sources called Ecemiş Balık Çifliği, Elekgölü and Zekinin Damları were selected to get the samples.

2.2 Methods

First, the geological, geotechnical and hydrogeological properties of the area had been determined. Then, three sources called Ecemiş Balık Çifliği, Elekgölü and Zekinin Damları, were selected. Subsequently, water samples from these three sources were taken in February and July to represent the seasons of winter and summer. Isotope analysis of these samples have been made, in laboratory of Tubingen University, to understand relationship between groundwater and landslides. Geochemical analysis have been made to determine the potability and availability of irrigation. The ions in water samples taken from sources were determined.

3 Results and Discussions

3.1 Geology

The geological map of the study area is shown in Figure 3. The Mesozoic and Cenozoic units are located in the study area. Upper Triassic settlement aged rocks, schist and marble, are situated in the north and northwest of the study area and form the basis. Cretaceous settlement aged melange with limestone and serpentine lies tectonically over this unit. This melange is located on south, southeast and east of the study area. This unit is overlaid tectonically by Tertiary– Cretaceous settlement aged melange with spilitic basalt, gabbro, limestone and similar components.

These complex are overlaid unconformably by Middle - Upper Paleocene aged Çamardı formation which is marl-mudstone-sandstone-clayey limestone in the northwest of the study. Eocene aged Kaleboynu formation overlies unconformably Çamardı formation with limestone-sandstone-conglomerates. Than Oligocene aged Çukurbağ formation comes unconformably with sandstone-conglomerate-siltstone and mudstone in the north and northeast of the study area. Miocene aged Burç formation consisting of marl and sandstone comes on Çukurbağ formation unconformably in the north of the study area. Later, Miocene aged flysch comes with angular unconformity in the south. Pliocene aged lake sediments are located unconformably in a narrow area in the north. Plio-Quaternary settlement aged Çatalca formation overlies on the old units unconformably in the east. Finally, Quaternary aged units, terrace sediments, talus, clay cover and alluvium deposits are located in the area (Yetiş, 1978).

Figure 2. Slide masses in Ecemiş Fault Zone.

3.2 Mechanism of Landslides

The study area is bounded by Aladağlar between 2000 and 3700 meters elevation on the east. This area has more precipitation than the study area (800 - 1600 m) and precipitation type is usually snow. This mountain mainly consists of karstic limestone besides peridotite, serpentinite and clastic rocks. As seen in Figure 4,

Miocene aged impermeable and semi-permeable sedimentary units with claystone-mudstone (Mif) overlay on karstic limestone unit of Cretaceous settlement aged complex (Kkk). Groundwater table changes more than 300 m (30 bar) annually, in the Kkk under the Mif (Leventeli, 2002). Meteoric waters enter to the Kkk from the higher parts of Aladağlar and creates several meters thick slide masses (Qk) by artesian under the Mif. Billions of cubic meters of slide masses are located in the eastern part of the Ecemiş Fault Zone with this type of mechanism. Flow of resources on the heel depends on thickness of the impermeable-semipermeable unit overlies karstic limestone as well as the season.

3.3 Isotope Hydrology

Water samples taken from the field were performed to determine the origin and during these studies SMOW method was used (Craig, 1961; Canik, 1998). The results of the analysis are shown in Table 1, Table 2 and Figure 5. The analysis show that the origin of water is meteoric. This result means that water is one of the main causes of the landslide in the study area.

3.4 Geochemical Analysis

Geochemical analysis were performed to determine physical and chemical properties of water in the study area.

Samples of water taken from sources contain ions are determined as mg/lt by Atomic Absorption Spectrophotometer. The obtained results are given in Table 3. However, the chemical reaction power of the molten element, is not its weight, is related with the number of reactive equivalents. So, besides the values which were determined as milligrams per liter of cations and anions, they were also determined in milliequivalents per liter (Table 4).

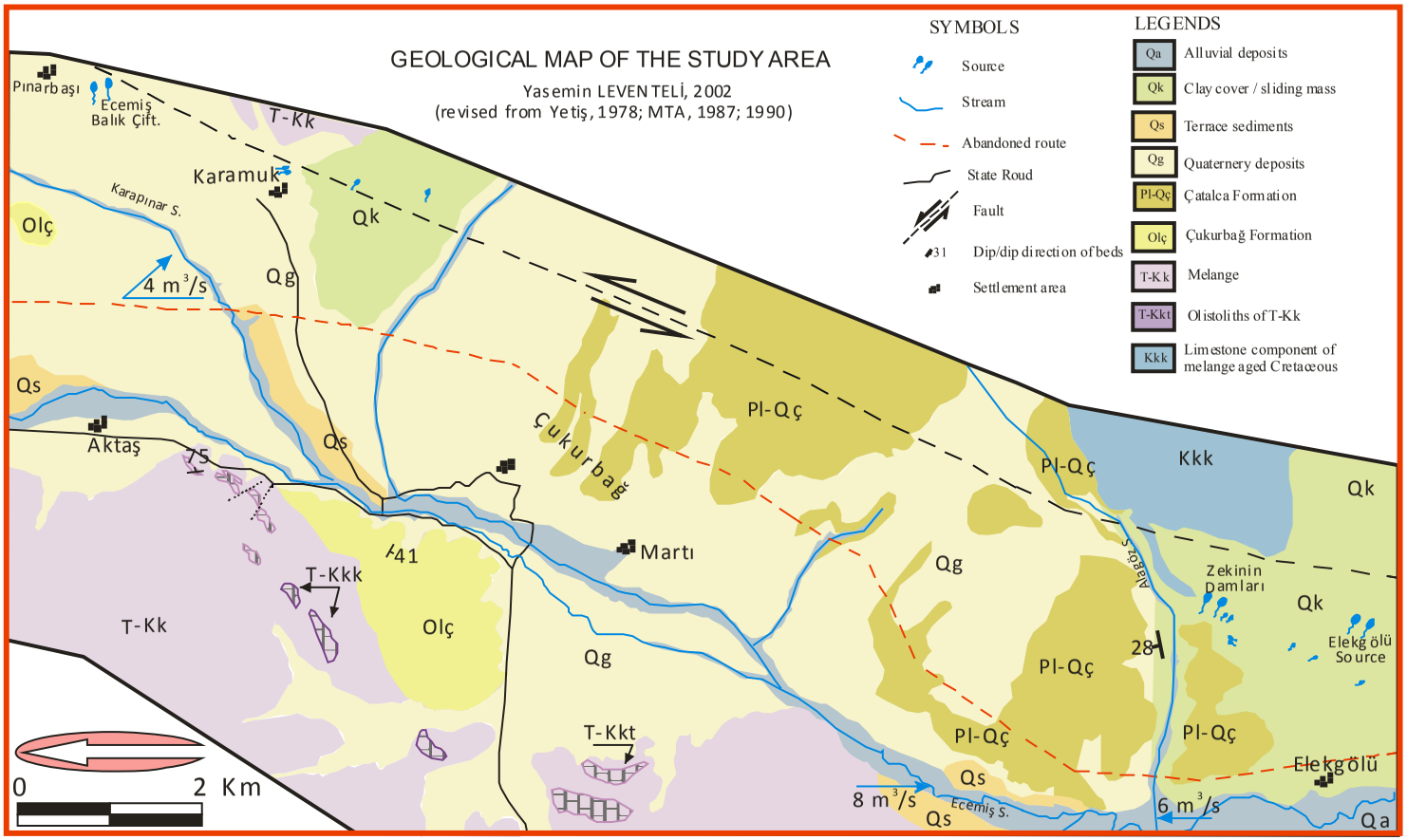

Figure 3. Geological map of study area.

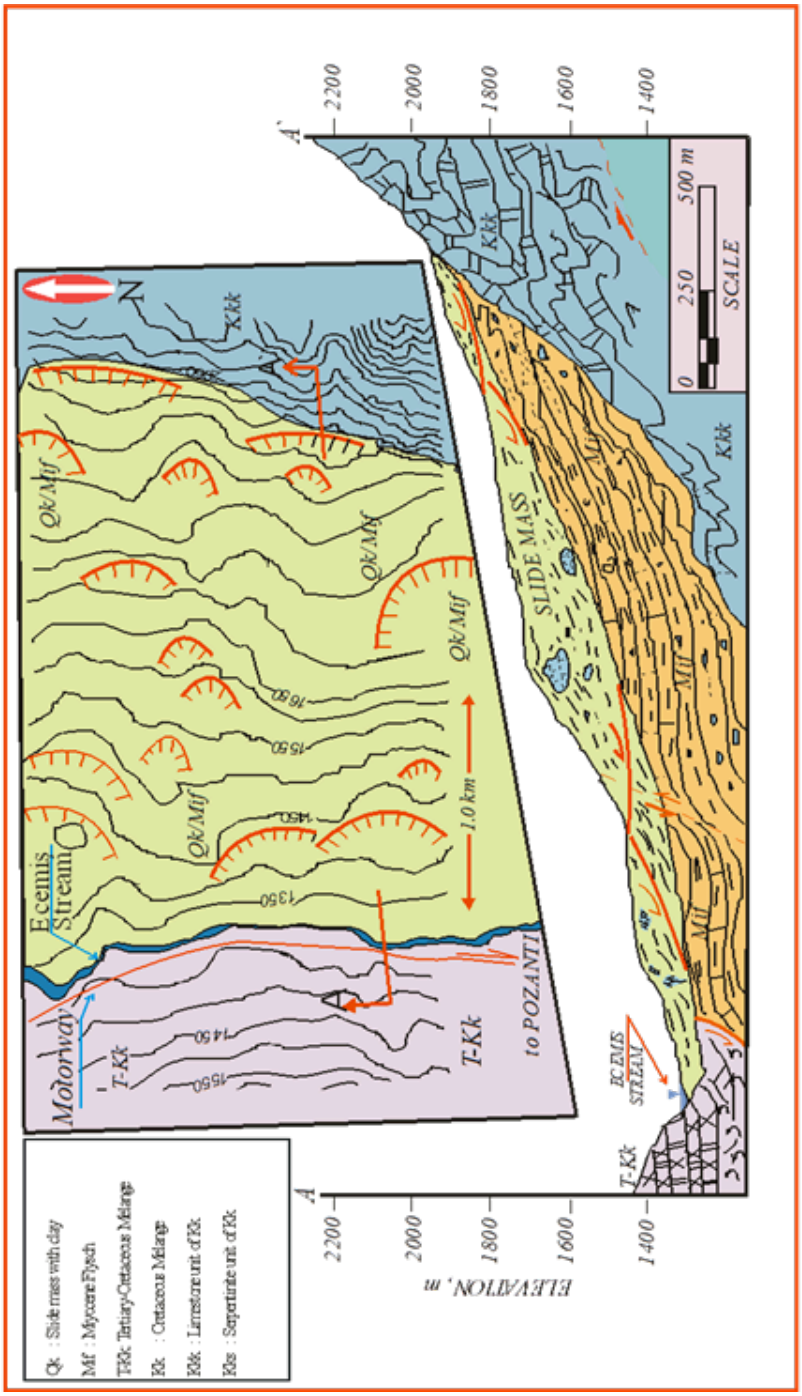

Figure 4. A typical landslide observed in Ecemiş Fault Zone (Leventeli and Yilmazer, 2003, Leventeli et al., 2013)

Table1. The results of isotope analyzes of water samples taken on February 2001.

SOURCE		$\delta^{18}O$ (‰) VSMOW	$\delta^{18}O$ (‰) raw	SOURCE		δD (‰) VSMOW	δD (‰) raw
Ecemiş Balık Çiftliği		-11,27	-12,08	Ecemiş Balık Çiftliği		-79,63	-75,95
		-11,51	-12,32			-78,63	-74,94
	Average	-11,39	-12,20		Average	-79,13	-75,45
	Standard Deviation	0,12	0,12		Standard Deviation	0,50	0,51
Elekgölü		-10,30	-11,11	Elekgölü		---	-64,76
		-10,33	-11,14			---	---
	Average	-10,31	-11,13		Average	-68,47	---
	Standard Deviation	0,02	0.02		Standard Deviation	---	---
Zekinin Damları		-9,91	-10,72	Zekinin Damları		-67,86	-64,15
		-9,94	-10,75			-66,91	-63,19
	Average	-9,92	-10,74		Average	-66,90	-63,18
	Standard Deviation	0,01	0,02		Standard Deviation	0,79	0,80

Table 2. The results of isotope analyzes of water samples taken on July 2001.

SOURCE		$\delta^{18}O$ (‰) VSMOW	$\delta^{18}O$ (‰) raw	SOURCE		δD (‰) VSMOW	δD (‰) raw
Ecemiş Balık Çiftliği		-11,88	-13,16	Ecemiş Balık Çiftliği		-76,8	-81,7
		-11,71	-12,99			-75,9	-81,1
	Average	-11,79	-13,07		Average	-76,4	-81,4
	Standard Deviation	0,09	0,09		Standard Deviation	0,4	0,3
Elekgölü		-10,35	-11,63	Elekgölü		-63,2	-72,6
		-10,35	-11,63			-65,3	-74
	Average	-10,35	-11,63		Average	-64,3	-73,3
	Standard Deviation	0.00	0.00		Standard Deviation	1.0	0,7
Zekinin Damları		-10,05	-11,33	Zekinin Damları		-60,8	-71
		-10,02	-11,3			-59,8	-70,3
	Average	-10,04	-11,32		Average	-60,3	-70,7
	Standard Deviation	0,01	0,01		Standard Deviation	0,5	0,3

The French hardness preferred to determine the hardness of water samples taken from study area and the following equations were used for it (Şahinci, 1991); the results are given in Table 5.

Total Hardness (FS) = 0.2497Ca + 0.4115Mg (1)

Total Hardness (FS) = 5 (rCa + rMg) (2)

Schoeller diagram, which is common in hydrogeolgy, has been used to determine water potability (Figure 6).

Excess of dissolved ions in irrigation water affect plants and soil by physical and chemical ways and reduce the yield. These ions cause to reduce the osmotic pressure in the cells of the plant and the water can not reach to the branches and leaves; then they disrupt the metabolism of plants. Therefore, Wilcox (Figure 7) and U.S. Salinity Laboratory (Figure 8) diagrams were used to determine the chemical properties of water in the study area, due to be evaluated in terms of agriculture. However, first SAR and % Na values were determined in these diagrams (Table 6).

Table 3. The chemical analysis results of water received during the months of February and July (mg/lt).

Months	Source	Cations(mg/lt)			Anions (mg/lt)				Totol Ions (mg/lt)
		Na	K	Ca	Mg	Cl	SO_4	HCO_3	
February	Ecemiş Balık Çift.	1,00	0.25	40.0	5.0	10,6	2,32	129,3	188,47
	Elekgölü	2,50	0.25	55.0	3.0	15,9	2,73	175,6	254,98
	Zekinin Damları	2,75	0.50	52.5	12,17	11,5	4,4	207,4	291,22
July	Ecemiş Balık Çift.	0,2	0,29	12,75	2,8	5,3	2,5	122	145,84
	Elekgölü	2	0,29	22,75	1,87	6,2	2,65	146	181,76
	Zekinin Damları	2,57	0,29	21,25	6,33	7,1	3,95	190,3	231,79

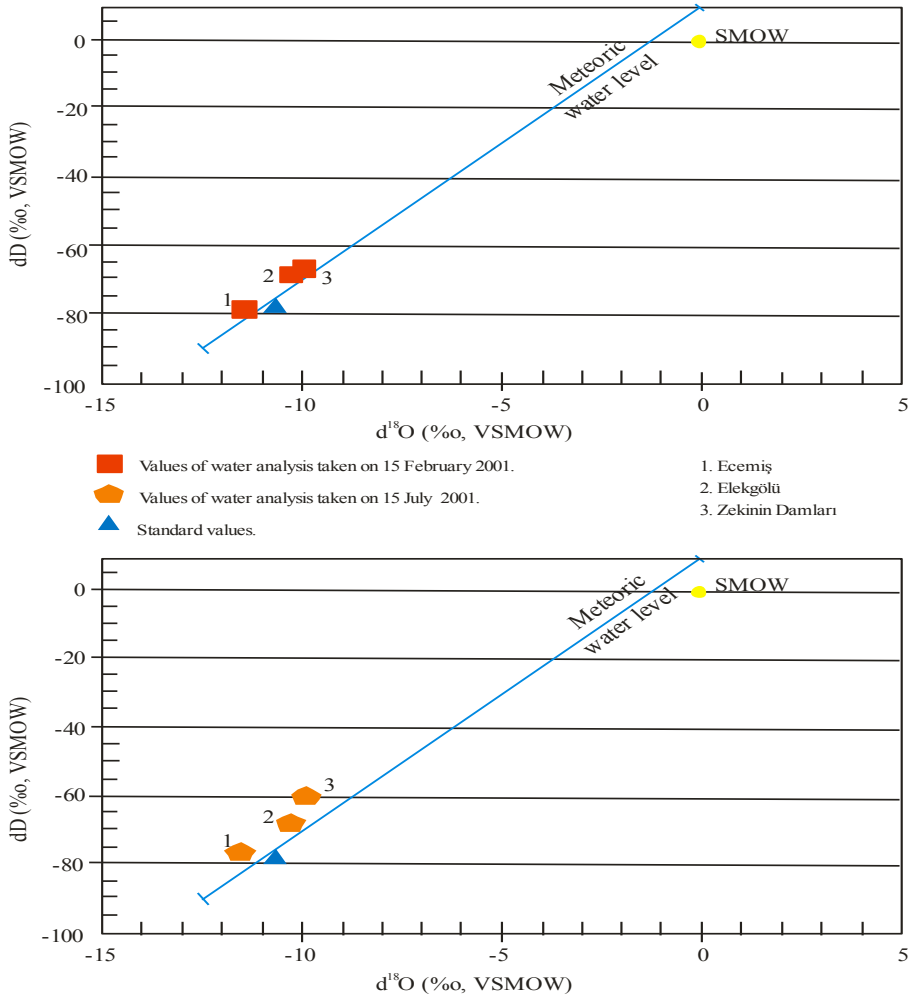

Fig. 5. Result of isotope analysis.

Table 4. The chemical analysis results of three different sources water taken on February and July (mek/lt).

Months	Source	EC	Cations (mek/lt)				Anions (mek/lt)			Total Ions (mek/lt)	French Hard.
			Na	K	Ca	Mg	Cl	SO_4	HCO_3		
February	Ecemiş Balık Çiftliği	269.24	0.043	0.0064	2.000	0.416	0.298	0.048	2.119	4.930	12
	Elekgölü	364.26	0.108	0.0064	2.750	0.25	0.447	0.056	2.878	6.495	15
	Zekinin Damları	416.03	0.119	0.0128	2.625	1.058	0.323	0.091	3.400	7.629	18
July	Ecemiş Balık Çiftliği	208.34	0.0087	0.0074	0.637	0.233	0.149	0.052	2.000	3.087	4.3
	Elekgölü	259.66	0.086	0.0074	1.137	0.155	0.175	0.055	2.393	4.008	6.4
	Zekinin Damları	331.13	0.111	0.0074	1.062	0.527	0.200	0.082	3.119	5.108	7.9

Table 5. Classification of water according to French Hardness (Şahinci, 1991).

		French Hardness					
Months	**Source**	**0-7.2**	**7.2-14.5**	**14.5-21.5**	**21.5-32.5**	**32.5-54.0**	**>54**
February	Ecemiş Balık Çiftliği		*				
	Elekgölü			*			
	Zekinin Damları			*			
July	Ecemiş Balık Çiftliği	*					
	Elekgölü	*					
	Zekinin Damları		*				
	Classification	Very soft	Soft	Moderate Hard	Quite Hard	Hard	Very Hard

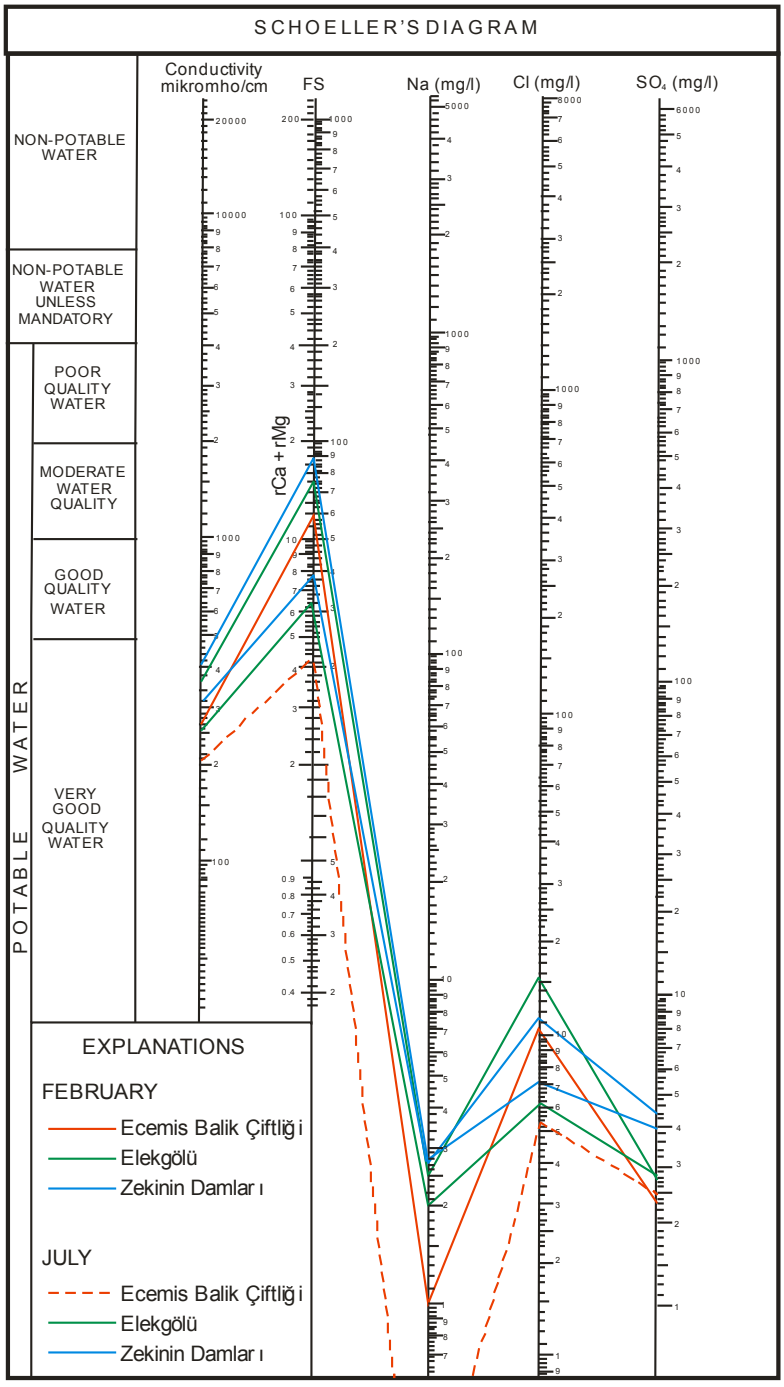

Fig. 6. Water classification according to Schoeller.

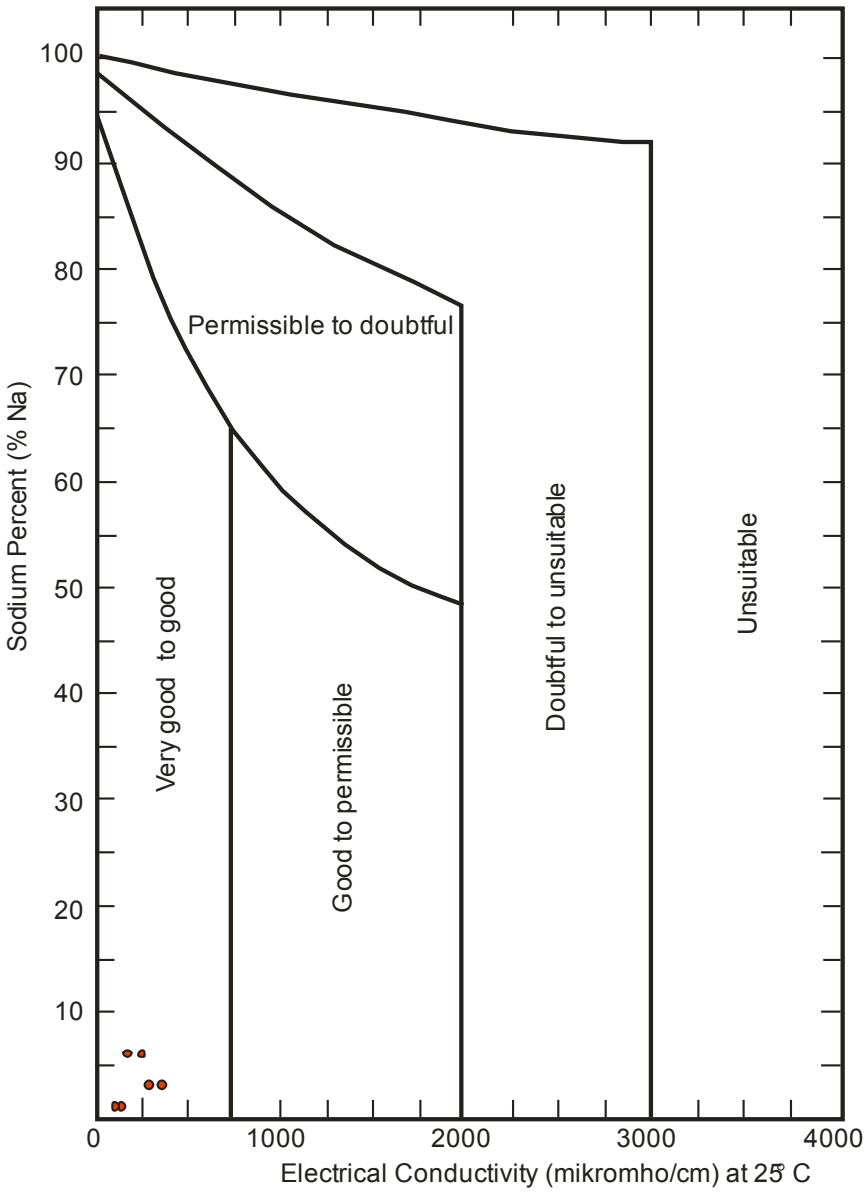

Fig. 7. Water classification according to Wilcox.

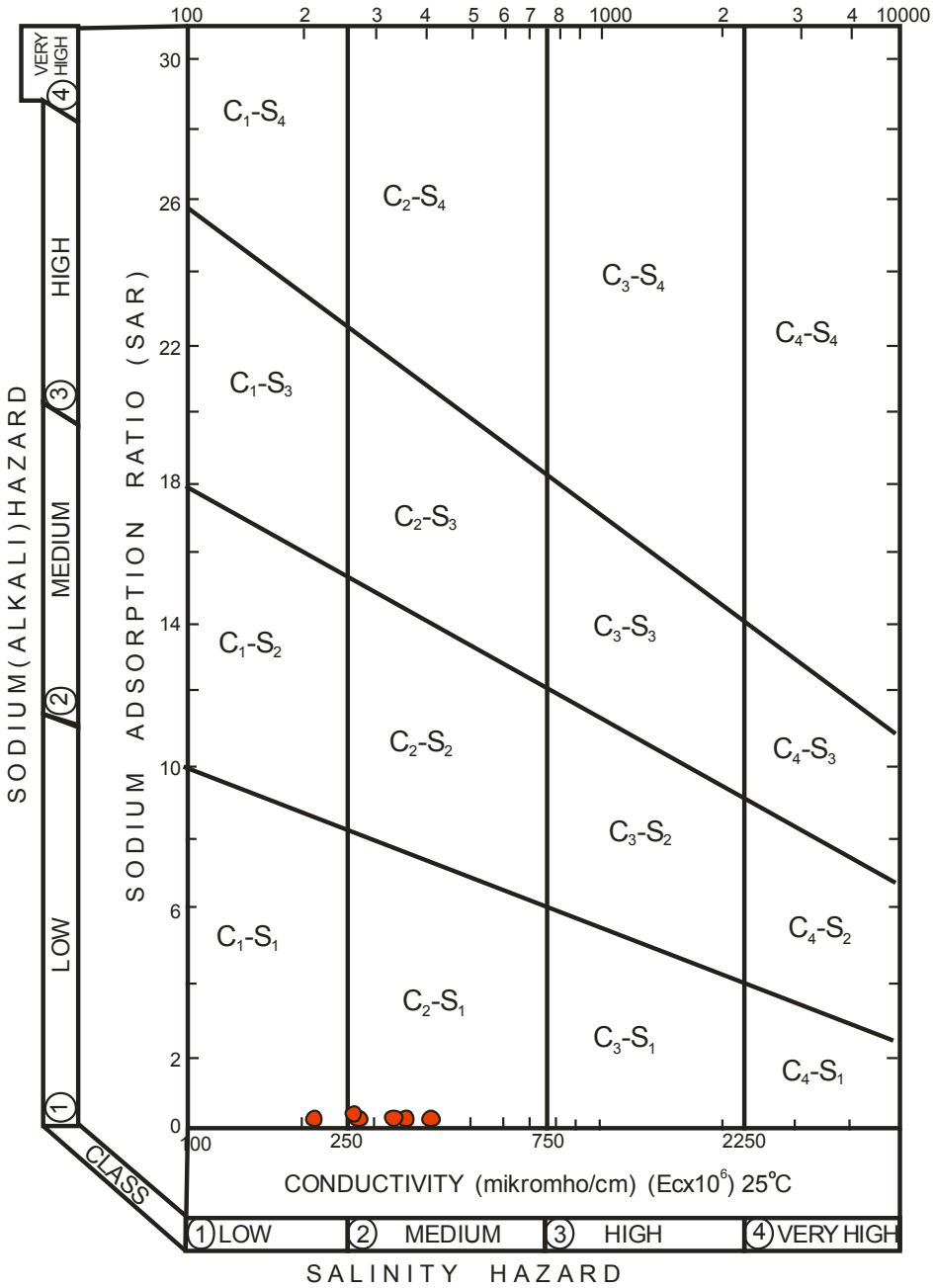

Fig. 8. Salinity and alkalinity hazard of water in USA Salinity diagram.

Table 6. SAR and % rNa values of water.

Months	Source	SAR	% Na
February	Ecemiş Balık Çiftliği	0.039	1.882
	Elekgölü	0.088	3.673
	Zekinin Damları	0.087	3.454
July	Ecemiş Balık Çiftliği	0.013	1.816
	Elekgölü	0.107	6.741
	Zekinin Damları	0.124	6.934

4 Conclusions

This study aimed to reveal the role of water in the formation of landslides and to understand the geochemical properties of it. The conclusions of this study are below:

1. Origin of water is meteoric. This is evidence for being one of the main causes of the slide in the study area. However, water is not alone in sliding. The trinity of water-discontinuity-clay (WDC) is main reason for the billions of cubic meters of large-scale slide in the zone.
2. The water-discontinuity-clay trinity created appreciably fertile lands for farming.
3. Water's hardness ranges from "*very soft*" to "*less hard*" according to the French hardness classes and hardness falls in the summer .
4. The Schoeller diagram used in the study area demonstrated that water is drinkable.
5. According to the Wilcox diagram, water is classified as "very good-good" for agricultural usage.
6. U.S. Salinity Laboratory diagrams show that water is located in C_1-S_1 and C_2-S_1 classes. It means water has low- medium salinity and low sodium. According that; all type plants, except sodium-sensitive plants, can be grown.
7. Therefore, any engineering project implemented without considering geotechnical parameters will lead to the reactivation of landslides and destroy settlement areas and gorgeous fertile plain in the region.

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Session 3: Agricultural Mobile Apps

Vacuum Regulation with a VFD Controller: Preliminary Tests and Modeling of the Vacuum System

Radu Roşca[1], Petru Cârlescu[2], Ioan Ţenu[3], Radu Ciorap[4]

[1]Agricultural machinery Department, University of Agricultural Sciences and Veterinary Medicine Iaşi, Romania, e-mail: rrosca@uaiasi.ro
[2]Agricultural machinery Department, University of Agricultural Sciences and Veterinary Medicine Iaşi, Romania, e-mail: pcarlescu@yahoo.com
[3]Agricultural machinery Department, University of Agricultural Sciences and Veterinary Medicine Iaşi, Romania, e-mail: itenu@uaiasi.ro
[4]Bioengineering Faculty, University of Medicine and Pharmacy Iaşi, Romania, e-mail: radu.ciorap@bioinginerie.ro

Abstract. Using a variable frequency drive (VFD) in order to drive the vacuum pump of a milking machine allows a dramatic reduction in energy use, while still producing equivalent vacuum stability. The VFD technology is able to adjust the rate of air removal from the milking system by changing the speed of the vacuum pump motor. A PID controller was developed in order to command the electric motor driving the vacuum pump. The PID controller used by the vacuum regulating system was tuned using the Ziegler-Nichols tuning rules for the frequency response method. In order to proceed to a more systematic approach a mathematical model of the vacuum system was developed, assuming that the system consists of a single air tank, provided with a vacuum pump port and an air-using port. In order to validate the model and study the system's response to vacuum variation due to a pulse air leak the detachment (fall-off) of one teatcup was simulated; the teatcup was detached for 10, 20 and 30 seconds respectively. During the fall-off tests the rate of air flow into the system was measured by the means of a rotameter and the vacuum level was recorded. The experimental results were compared with the ones predicted by the model and it was concluded that the model accurately describes the response of the system.

Keywords: variable frequency drive, vacuum system model, teatcup fall-off test.

1 Introduction

The mechanical milking is achieved due to the vacuum applied to the teat, by the means of a teatcup. In order to limit the development of congestion and edema and provide relief to the teat from the milking vacuum, the pulsation principle is used (Mein *et al*., 1987). As shown in Figure 1, vacuum is applied to the teat through the vacuum chamber (7) created inside the liner (2). The collapse of the teatcup liner (2)

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beneath the teat is achieved when air at atmospheric pressure is admitted into the pulsation chamber (5) of the teatcup (Fig. 1a); the liner opens, allowing the extraction of milk, when vacuum is applied to the pulsation chamber (Fig. 1b).

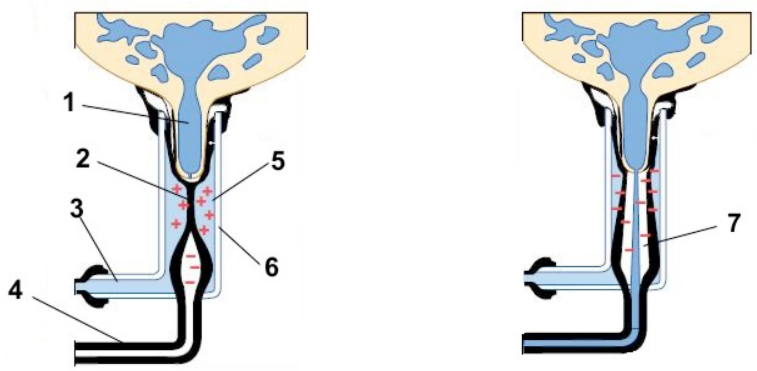


Fig 1. The principle of milk extraction (adapted from Dairy Processing handbook, 1995).
a-massage; b-milk extraction; 1-teat: 2-liner; 3-short pulse tube; 4-short milk tube; 5-pulsation chamber; 6-shell; 7-vacuum chamber.

Figure 2 presents the layout of a typical mechanical milking system (ISO 3918:2007), which contains a vacuum pump (2), driven by an electric motor (1); the vacuum pump creates vacuum into the vacuum pipeline (7), which is used for both the milk extraction and the pulsation of the liner. The vacuum level is regulated by the means of the vacuum regulator (4), placed downstream of the receiver. The vacuum pump is permanently operated at full capacity, providing a flow of air greater than the one entering the system through pulsators, claws, leaks. The difference between the air extracted by the pump and the necessary flow of air during milk extraction is compensated by the vacuum regulator, which opens to allow supplementary air to enter into the system when working vacuum increases above the desired level and closes when vacuum decreases below the necessary value; according to the ISO 5707:2007 standard the working vacuum should be maintained within ±2 kPa of the nominal vacuum.

The importance of vacuum level and stability is due to the fact that cows have a biological limit for a positive reaction to vacuum and exceeding it may lead to damage of the teat tissue or slipping of milking clusters off the teat, resulting in an extended milking time and in improper milking; vacuum fluctuations generated within the milking cluster may lead to direct bacterial penetration, thus causing mastitis (Pařilová *et al*., 2011).

In order to make the vacuum pump draw only the amount of air needed to maintain the desired vacuum level, the speed of the pump should be variable (as air flow depends on the pump speed); in this case no conventional regulator is needed to maintain the imposed vacuum during milking. The electric motor of vacuum pump is controlled by the means of a variable frequency driver (VFD). This solution has the

potential to significantly reduce the energy consumption of the milking system; in a study conducted by Pazzona *et al*. (2003) energy savings between 24 and 87% were reported. It was concluded that, if the VFD controller is adjusted properly, it can meet or even exceed the vacuum stability recorded by the systems equipped with conventional regulators (Pazzona *et al*., 2003; Reinemann, 2005), the target being a receiver vacuum within ±2 kPa of the vacuum set point during normal milking (ISO 5707:2007).

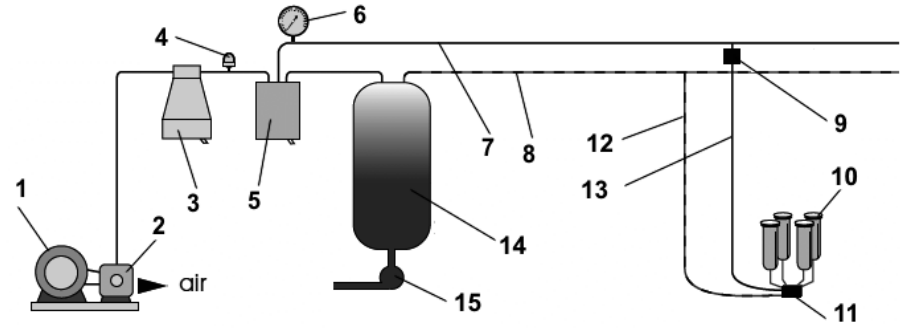


Fig. 2. Layout of a mechanical milking system.
1-electric motor; 2-vacuum pump; 3-interceptor; 4-vacuum regulator; 5-sanitary trap; 6-vacuum gauge; 7-permanent vacuum pipeline; 8-milk pipeline; 9-pulsator; 10-teatcup assembly; 11-claw; 12-long milk tube; 13-long pulse tube; 14-receiver; 15-milk pump.

The first stage of the study was aimed to validate the principle of the vacuum regulation by the means of the VFD controlled vacuum pump. In order to proceed to a more systematic approach of the problem in the second part of the paper a mathematical model of the vacuum system was developed and tested, based on the system's response to vacuum variation due to a pulse air leak - detachment (fall-off) of one teatcup.

2 Materials and Methods

A bucket type milking machine was tested and modeled; Fig. 3 presents the diagram of the milking system. The original system was equipped with a valve and spring type of vacuum regulator, placed on the pipeline connecting the interceptor (I) to the bucket (B); the electric motor (M) driving the vacuum pump (VP) was connected to the three phase power grid. A BRK pneumatic pulsator (P) was used to achieve the liner pulsation; the machine was equipped with four Boumatic R-1CX type teatcups. Artificial teats, manufactured according to the ISO 6690:2007 standard, were inserted into the teatcups. The vacuum pump provided an airflow $q=4.69 \cdot 10^{-3}$ m^3 s^{-1} at a speed of 1350 min^{-1}.

In order to use the VFD controller for driving the vacuum pump a Smartec SPD015AAsil absolute pressure sensor (T, fig. 3) was used to monitor the vacuum in

the permanent vacuum line, providing the pressure signal for the VFD controller. The electric signal from the pressure sensor was fed to the data acquisition (DAQ) board by the means of a signal conditioning unit (SC).

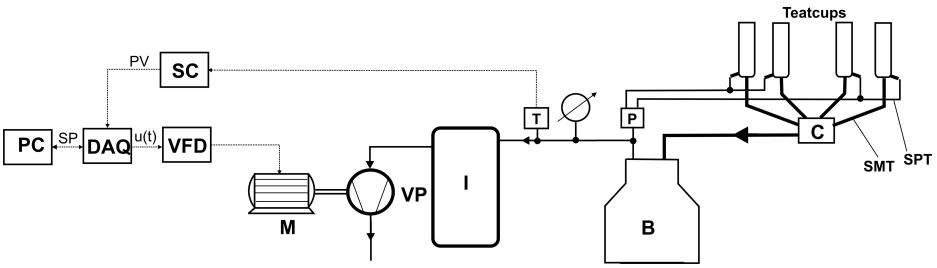


Fig. 3. Schematics of the tested milking system
DAQ-data aquision board; SC-signal conditioning unit; I-interceptor; VP-vacuum pump; M-electric motor; B-bucket; P-pulsator; SMT-short milk tube; SPT-short pulse tube; T-absolute pressure transducer; C-claw.

The data aquision board was USB 6009 (National Instruments), with a sample rate of 48 ksamples/s, four differential analog input channels and two analog output channels.

Based on the software running on the computer the entire system (DAQ board, VFD controller and computer) acts as a PID regulator for the vacuum level, for which the set point (SP) is the desired vacuum level and the process variable (PV) is the actual vacuum level in the vacuum pipeline. The controller calculates the output signal u(t), which is then used to command the VFD and adjust the running speed of the electric motor and vacuum pump. The PID controller output is given by the relation (Aström and Murray, 2008):

$$u(t) = K_p \cdot \left[e(t) + \frac{1}{T_i} \cdot \int e(t) \cdot dt + T_d \cdot \frac{de(t)}{dt} \right], \quad (1)$$

where the error signal is e(t) = SP-PV; K_P is the proportional gain, T_I is the integral time and T_d is the derivative time.

The PID controller was built with the help of the PID control toolbox from LabVIEW 7.1 and a virtual instrument was created in order to provide the control signal to the VFD. The control panel of the virtual instrument (Fig. 4) allowed the adjustment of the desired vacuum level (vacuum set point) and of the PID gains: proportional gain, integral time [min] and derivative time [min].

The output range of the PID controller was 0…5V, due to the characteristics of the data aquision board; an additional signal conditioning unit (not shown in Fig. 3) was used to obtain the 0…10V range imposed by the variable frequency drive.

An oscilloscope display allowed the visualization of the vacuum set point, system vacuum and output signal of the PID controller.

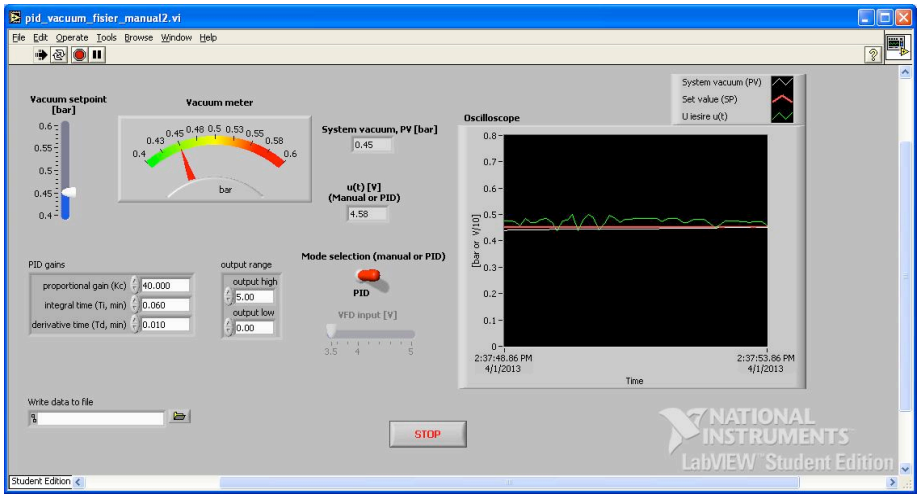


Fig. 4. The control panel of the virtual instrument

The variable frequency drive unit was VFD 007M43B (0.7 kW maximum power of the electric motor); the output frequency range was set to 0...60 Hz for a range of the analog comand signal comprised between 0 and 10V.

In order to establish the working parameters of the milking process (pulsation rate and ratio, duration of the phases), two additional Smartec SPD015Aasil absolute pressure sensors (not shown on the diagram in Fig. 3) were attached to the short pulse tube (SPT, Fig. 3) and short milk tube (SMT). The pulsation ratio was defined according to the specifications of the ISO 5707:2007 standard.

The Ziegler-Nichols tuning rules for the frequency response method were used; the disturbance was induced by changing the set point. After that the permanent vacuum values were recorded in a series of dry tests, performed for three vacuum levels: 0.35 bar, 0.40 bar and 0.45 bar (35, 40 and 45 kPa). In order to asses vacuum stability the results were compared, using the average value of the vacuum, the standard deviation and the standard error of the mean. Three tests were performed for each vacuum level and vacuum regulation method and the mean, standard error and standard error of the mean were calculated.

In order to evaluate whether there was a significant difference between the two pairs of data (the permanent vacuum levels recorded for two regulation methods) a statistical analysis was performed. The Kolmogorov-Smirnov test proved that data distribution was not normal; as a result, the Man Whitney rank sum test was performed; this test is a substitute for the two-sample t test when the samples are not normally-distributed populations (Panik, 2005). The analysis was performed with a demo version of the SigmaPlot 12.5 software.

The mathematical model of the vacuum system was developed assuming that the system is composed of a single air tank, provided with a vacuum pump port and an air-using port (Tan, 1992; Tan *et al*., 1993), as shown in Fig. 5, where $\dot{m}_1$ represents the mass airflow rate of the vacuum pump and $\dot{m}_2$ is the mass airflow rate into the system.

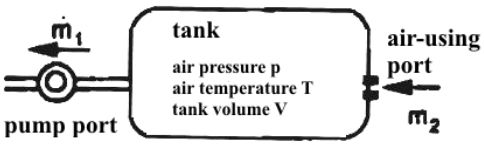


Fig. 5. Schematics of the milking system [5]

$\dot{m}_1$, $\dot{m}_2$-mass air flow rate

The following equations may be written [6]:

$$\frac{dM}{dt} = \dot{m}_2 - \dot{m}_1 = \dot{m}_2 - q \cdot \frac{M}{V} , \tag{2}$$

$$p = R \cdot T \cdot \frac{M}{V} , \tag{3}$$

where M is the mass of air in the air tank, V is the tank volume, q is the volumetric flow rate of the vacuum pump, R is the gas constant for air (R=287 $J \cdot kg^{-1} \cdot K^{-1}$) and T is the air temperature [K].

Using equations (2) and (3) the transfer function of the system is (Tan *et al*., 1995):

$$G(s) = \frac{p(s)}{\dot{m}_2(s)} = \frac{R \cdot T / q}{1 + s \cdot V / q} . \tag{4}$$

Fig. 6 presents the system response when the air flow rate increases due to the detachment of one teatcup: when the mass flow rate $\dot{m}$ increases by $\dot{m}_p$, the absolute system pressure p_n increases by p_p.

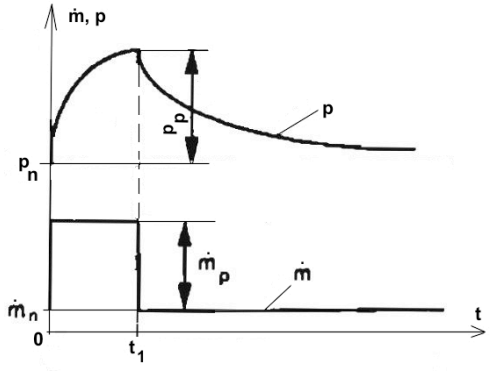


Fig. 6. Model response to mass airflow rate variation (Tan *et al*., 1993)

p-absolute pressure; t_1-detachment duration.

The mass flow rate resulting from the pulse air leak $\dot{m}_p$ is (Tan *et al*., 1993):

$$\dot{m}(s) = \frac{\dot{m}_p}{s} - \frac{\dot{m}_p}{s} \cdot e^{-t_1 \cdot s} . \tag{5}$$

Introducing equation (5) into equation (4) and applying the inverse Fourier transform finally leads to:

$$p(t) = \frac{R \cdot T}{q} \cdot \dot{m}_p \cdot \left[\Phi(t) - \Phi(t - t_1) - e^{-q \cdot t / V} + \Phi(t - t_1) \cdot e^{-q \cdot (t - t_1) / V}\right], \quad (6)$$

where $\Phi(t)$ is the step function, defined as follows:

$$\Phi(t) = \begin{cases} 0, & \text{if} \quad t < 0 \\ 1, & \text{if} \quad t \geq 0 \end{cases}. \quad (7)$$

For the milking system taken into account the singe tank volume (which includes the interceptor volume and the bucket volume) was $V=3.5 \cdot 10^{-2}$ m^3 and the air temperature was T=293 K.

In order to validate the model and study the system's response to vacuum variation due to a pulse air leak the detachment (fall-off) of one teatcup was performed; the teatcup was detached for 10, 20 and 30 seconds respectively. During the fall-off tests the rate of air flow into the system was measured by the means of a rotameter and the evolution of the vacuum level was recorded using the pressure sensor (T, Fig. 3).

The air flow rate into the system during the fall-off test was $\dot{m}_p = 7.6 \cdot 10^{-5}$ $kg \cdot s^{-1}$ (average value).

The steady state gain K of the model and the time constant τ were calculated with the relations (Tan *et al*., 1993):

$$K = \frac{R \cdot T}{q}, \quad \tau = \frac{V}{q}. \quad (8)$$

For the milking system taken into account the following values were obtained:

- $K = 1.79 \cdot 10^5$ $kPa \cdot s \cdot kg^{-1}$;
- $\tau = 7.47$ s.

Using the experimental data the system steady state gain K_s and the time constant τ_s were evaluated. The system steady-state gain was calculated with the formula:

$$K_s = \frac{\Delta p}{\dot{m}_p}, \quad (9)$$

where Δp is the vacuum drop when the teatcup is detached.

The time constant τ_s was considered to be the time required for the output vacuum to reach 63.2% of the final value when the teatcup was detached.

3 Results and Discussion

3.1 Vacuum stability

In order to tune the PID controller using the Ziegler-Nichols tuning rules for the frequency response method, the integral time was set at 10000 and the derivative time was set to 0; the proportional gain was adjusted until the oscillations were sustained and had a constant amplitude. Finally, the critical gain was $K_c = 68$. The critical period T_c was measured using the recorded vacuum signal; it was established that the critical period was $T_c = 7.53 \pm 0.46$ s. The PID gains were then calculated using the formula presented in Table 1 (Aström and Murray, 2008).

Table 1. Controller parameters for the Ziegler-Nichols frequency response method

Controller type	K_P	T_i	T_d
P	$0.5 \cdot K_c$	-	-
PI	$0.4 \cdot K_c$	$0.8 \cdot T_c$	-
PID	$0.6 \cdot K_c$	$0.5 \cdot T_c$	$0.125 \cdot T_c$

For the case of the PID controller, the following gains were obtained: $K_P = 40$, $T_i = 4.76$ s (0.062 min), $T_d = 0.941$ s (0.015 min).

The results referring to the working parameters of the system and vacuum stability are shown in Tables 2 and 3.

Table 2. Working parameters of the milking system

Regulation method	Item	Vacuum level [kPa]		
		35	40	45
Vacuum regulator	Pulsation rate [cycles/min]	48.4±0.231	51.9±0.266	55.9±0.200
	Pulsation ratio [%]	55.1/44.9	53.7/46.3	53.3/46.7
	Duration of b phase* [%]	44.9±0.137	41.98±0.362	39.74±0.270
	Duration of d phase** [s]	0.42±0.005	0.387±0.003	0.343±0.003
PID controller	Pulsation rate [cycles/min]	48.9±0.352	52.2±0.500	56.4±0.167
	Pulsation ratio [%]	54.6/45.4	53.8/46.2	53.2/46.8
	Duration of b phase [%]	44.02±0.352	41.21±0.405	39.40±0.113
	Duration of d phase [s]	0.42±0.006	0.387±0.012	0.337±0.003

Notes: *at least 30% of the cycle duration; **at least 0.15 s.

The results presented in Table 2 show that the working parameters of the system (pulsation rate and ratio, duration of the cycle phases) did not change significantly when passing from the classical method for vacuum regulation (based on the use of a

valve type regulator) to the new one, based on the adjustment of the vacuum pump speed. A slight increase of the pulsation rate was however noticed when the second method was used, but the differences did not exceed 1%; the slightly higher pulsation rate resulted in a shorter b phase when the PID controller was used for vacuum regulation, but the requirements of the ISO 5707 standard were fulfilled.

An analysis of the individual values of the permanent vacuum showed that, for the both methods, the working vacuum was maintained within ±2 of the nominal vacuum kPa, in accordance with the requirements of the ISO 5707 standard.

The results presented in Table 3 show that the use of the PID controller method for vacuum regulation led to lower standard deviations and standard errors of the mean than the ones recorded when the classical vacuum regulator was used, proving a better vacuum stability.

The statistical analysis of the results, performed by the means of the Man Whitney rank sum test (SigmaPlot ver. 12.5, demo), confirmed that, for each set value of the vacuum level (35, 40 and 45 kPa, respectively) there were significant differences between the two sets of data.

Table 3. Results regarding vacuum stability

Regulation method	Item	Vacuum level (SP) [kPa]		
		35	40	45
Vacuum regultor	mean vacuum level, $\bar{x}$ * [kPa]	34.417	39.462	44.398
	standard deviation, S [kPa]	0.202	0.230	0.226
	standard error of the mean, $S_{\bar{x}}$ ** [kPa]	0.0142	0.0162	0.0159
PID controller	mean vacuum level, $\bar{x}$ [kPa]	34.514	39.381	44.580
	standard deviation, S* [kPa]	0.172	0.194	0.186
	standard error of the mean, $S_{\bar{x}}$ ** [kPa]	0.0121	0.0137	0.0131

Notes: *for 200 recorded values; **$S_{\bar{x}} = S/\sqrt{n}$

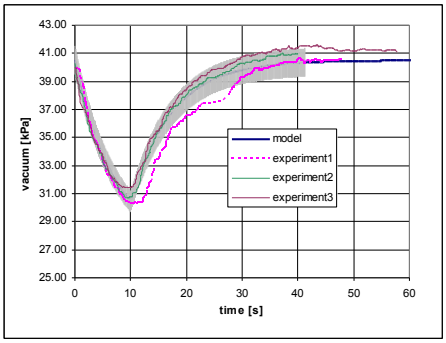
3.2. Vacuum system model

Fig. 7 presents the experimental results of the fall-off tests; the model data ("model") and data from three experimental replicates ("experiment 1", "experiment 2", "experiment 3") are shown on each chart, with the ±2.5% y errors bars superposed over the model curve.

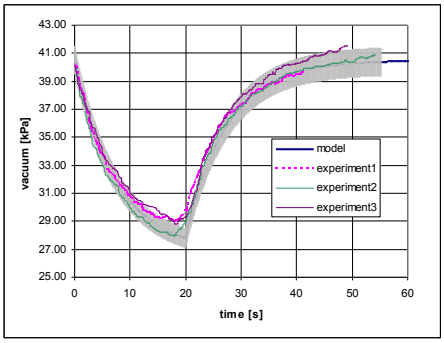
The tests clearly show that there are only small differences between model and experimental data and that the curves corresponding to the experimental data follow closely the theoretical curves predicted by the model, the majority of the experimental data being within the ±2.5% variation domain.

Table 4 presents the results concerning the steady-state gain and time constant obtained from the experimental results; the experimental steady-state gain is with 9% lower than the value given by the model and the time constant of the system is with

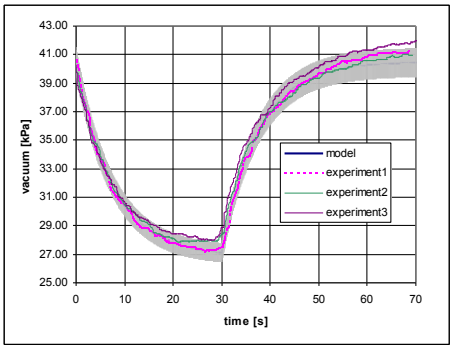
20% lower than the value predicted by the model.



a)



b)



c)

Fig. 7. Experimental and model data

a) 10 s detachment of the teatcup;
b) 20 s detachment of the teatcup;
c) 30 s detachment of the teatcup.

Table 4. Experimental results for the time constant and steady-state gain

Teatcup detachment time [s]	Item	
	$K_s \cdot 10^{-5}$ [kPa·s/kg]	τ_s [s]
10	1.34	4.72
20	1.72	5.7
30	1.82	7.6
Average	1.63±0.146	6.00±0.845

The inaccuracy of the predicted time constant may be due to the assumptions that air is a perfect gas and that the system is isothermal, with only small variations of the air temperature (Tan, 1992; Tan *et al*., 1993). If the process is considered adiabatic (Tan *et al*., 1993; Tan *et al*., 1995), the time constant is calculated with the relationship:

$$\tau = \frac{V}{\gamma \cdot q}, \tag{10}$$

where γ=1.4 is the heat capacity ratio of air.

As a result the time constant of the model becomes τ=5.33 s, a value which is

much closer to the average value of 6 s given by the experiments (12,5% lower).

4 Conclusions

The permanent vacuum level in a bucket milking machine was adjusted by the means of a PID regulator, using a variable frequency driver in order to power the electrical motor driving the vacuum pump. The PID regulator, implemented using the NI LabView capabilities, was aimed to maintain a constant vacuum level.

The PID regulator was tuned in order to establish the PID gains using the Ziegler-Nichols frequency response method.

A series of dry tests were performed, at different vacuum levels, in order to compare the two methods of vacuum regulation (using a mechanical vacuum regulator and a PID regulator, respectively); the tests proved that vacuum regulation by the means of the PID controller has the potential to replace the classical method of regulation as it did not adversely affect the working parameters of the system, while achieving better results regarding the stability of the permanent vacuum.

As the principle of the vacuum regulation by controlling the vacuum pump speed was confirmed the next step was to develop a mathematic model of the milking system in order to proceed to a more rigourous analysis of the system. As a first step a simplified physical model was adopted, considering the mechanical milking system as first order dynamic system with a single air tank, provided with a vacuum pump port and an air-using port.

In order to validate the model and study the system's response to vacuum variation due to a pulse air leak the detachment (fall-off) of one teatcup was simulated; the teatcup was detached for 10, 20 and 30 seconds respectively. During the fall-off tests the rate of air flow into the system was measured by the means of a rotameter and the vacuum level was recorded.

As a result of the tests it was concluded that the developed model is accurate, the majority of the experimental values being comprised within the ±2.5% range of the model.

However, the assumption that the process is isothermal led to a relatively high difference between the predicted value of the time constant and the value obtained during the experiments. This difference diminished if the adiabatic hypothesis was considered.

Developing a more complex model of the milking system is taken into account for a future work, aiming to obtain more accurate predictions.

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An Online Analytical Processing (OLAP) Database for Agricultural Policy Data: a Greek Case Study

Michael Maliappis[1], Dimitris Kremmydas[2]

[1]Laboratory of Informatics, Department of Agricultural Economics & Rural Development, Agricultural University of Athens
[2]Laboratory of Agribusiness Management, Department of Agricultural Economics & Rural Development, Agricultural University of Athens

Abstract. Statistical data for agricultural policy analysis has certain unique features: a multitude of sources of very different nature; a variety of dimensional granularity; different end user requirements. The utilization of Data Warehouse technology would be valuable for overcoming the above data issues. In this paper, we describe the technologies involved and the data modeling requirements, making an exemplar implementation for few tables of the Greek agricultural census.

Keywords: Agricultural Data, Data warehouse, OLAP, Agricultural Policy.

1 Introduction

Data related to agriculture is of prime importance for agricultural policy research. Based on available data, policy makers are making qualitative judgments and researchers build their models. However, this kind of data bears certain features that need special attention. Firstly there exist many sources of information, e.g. Eurostat, FADN, national surveys, field surveys from universities, etc, none of which should be discarded because agricultural data is actually a scarce resource. Secondly, as a result of the nature of agricultural activity, the related data expand horizontally on many dimensions, e.g. biophysical (what is the effect on the soil of a certain crop, etc.), technical (what inputs a certain crop needs, etc.), economic (what is the cost per hectare for cultivating a certain crop, etc.), social (what is the age distribution of farmers in a certain area). Thirdly, the temporal and spatial dimensions are directly relevant and should always be attached; otherwise data loses its context thus shrinking its quality. Fourthly, almost any of the dimensions of agricultural data is of a hierarchical kind. For example the spatial dimension can extend from a small community to the whole EU and at the same time information regarding the finest geographical scale makes sense to be aggregated. Finally agricultural data for policy analysis are utilized by different kind of users, each having diverse needs. For example for a policy maker it would be sufficient to browse the data while for an

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agricultural policy modeller the data would ideally be directly imported to his / her model.

Moreover, the new CAP (2014-2020) is focusing on farm scale measures, thus the need for more low level data is emerging. The problem is that considering the above characteristics of agricultural data, a new approach for storing and presenting them should be considered. The Data Warehouse (DW) approach, followed by On-Line Analytical Processing (OLAP) system for data analysis, seems to be a natural choice (Boulil et al.,2014, Rai et al., 2008). Adoption of DW and usage of OLAP is a mean to move from data to information and then to knowledge.

All the above mentioned data are usually stored into conventional data storage means, following the relational database model. Moreover, they follow their own unrelated and incompatible data storage models. Relational Database models are optimized to handle simple transactions coming from a relative large number of users in real time. This orientation makes them unsuitable or less suitable to organize agricultural data for advanced data analysis. Advances in storage technology provide the means to effectively combine data coming from several incompatible and diverse sources into a DW. The storage structure of DW offers the proper organization of data to implement data analysis tools, such as OLAP, on huge amount of data.

There are several cases where a DW was introduced to agricultural statistical data. One of the earliest attempts was that of the US Department of Agriculture's National Agricultural Statistics Service (Yost, 2000). Another attempt was that of the development of a central Data Warehouse at Indian Agricultural Statistics Research Institute (IASRI) at New Delhi (Chaturvedi et al., 2006).

In this paper, we propose an initial layout for a DW organizing Greek agricultural data and supporting a minimal implementation of an OLAP system for agricultural policy analysis. The paper describes the process towards the implementation of the DW. Section 2 discusses the technologies involved, section 3 describes the data modeling process and section 4 investigates the several difficulties identified during a case study on Greek Agriculture.

2 Data Warehouse Technology

To provide an effective data analysis for agricultural data several tools and technologies are needed. The data should be obtained from several sources, relational databases or flat files of several formats, transformed and loaded into a Data Warehouse (DW) (Kimball and Ross, 2013). From the DW several data marts can be created as a basis for the desired OLAP cubes and the final data analysis.

A **Data Warehouse** is meant to be the single, integrated, storehouse of data, mainly historical, that can be used for supporting an organization's decision process. As such, it contains data covering a wide range of topics and business processes, for instance finance, logistics, marketing, and customer support. Often, a data warehouse cannot be accessed directly by end user tools. A **data mart**, in contrast, is meant for direct access by end users and end user tools, and has a limited specific analytical purpose, for instance Retail Sales or Customer Calls.

DW are constructed to answer “who?” and “what?” questions about past events using a huge amount of historical data. The development of DW is usually based on relational data base engines with specialized extensions to handle the intricacies and special needs of DW.

OLAP is a multidimensional view of aggregated data stored in a DW and corresponds to a specific data mart. This view allows analysts and managers to gain insight into data of interest quickly, consistently and with high interaction capabilities. OLAP analysis ranges from basic navigation and browsing, using slice and dice, to statistical analyses, to more serious analyses such as time series and complex modeling.

The implementation of OLAP data analysis is accomplished using **OLAP Cubes**. OLAP cubes are structures designed by using a dimensional model which represents the relationships between facts and dimensions. The facts are the measures of interest that are stored into the DW and dimensions are the qualitative variables concerning these measures. The dimensional model is usually implemented using the star schema. A star schema is a schema that allows the dimension tables to be joined directly with the fact table as is shown if Fig. 1.

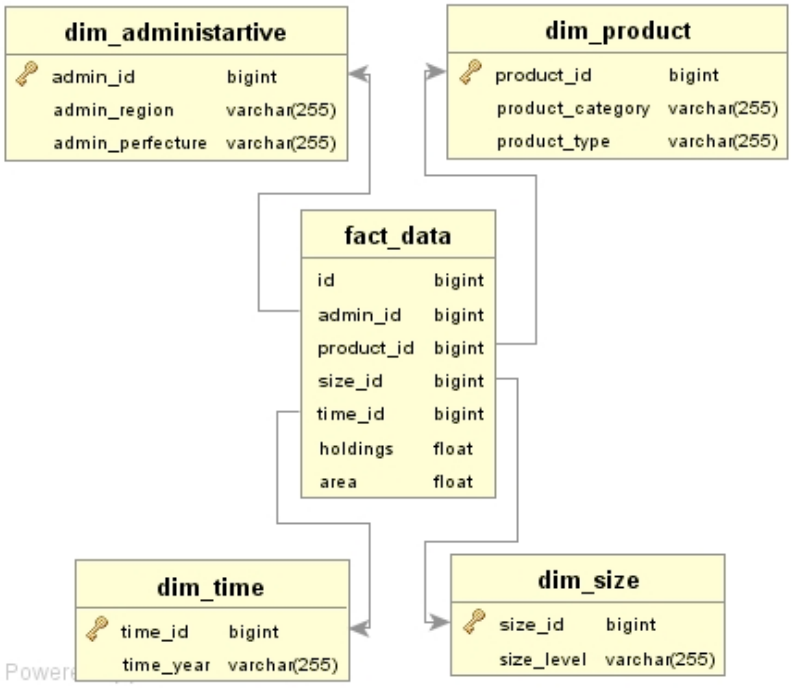


Fig. 1. Star Schema

The structure of OLAP cubes allows easy navigation through the dimensions of data using several operations, such as **slicing** which sets one dimension constant to show a two-dimensional table, **dicing** which creates a sub-cube, **drill down/up**

which facilitates navigation from most summarized (up) to more detailed (down) levels and **roll-up** which summarizes the data along a dimension.

The implementation presented in this paper uses MySQL[1] as DW storage data base, Kettle[2] to facilitate collection, transformation and loading of data and Mondrian[3] to create the OLAP cube and apply data analysis. All of the above tools are distributed with free licenses.

3 Data Modeling

The process of DW development is simply the mapping of the source schemas contained in the source data model (structure of the underlying data sources and the relationships between them), to the target schema of the DW model and populate the target tables. This process follows several well defined steps. As is shown in Fig. 2, the data are collected from several sources, extracted in proper form, transformed as needed and loaded into the DW. Using the data of the DW the data marts are created as a basis to OLAP cubes and the other forms of data analysis (Casters et al., 2010).

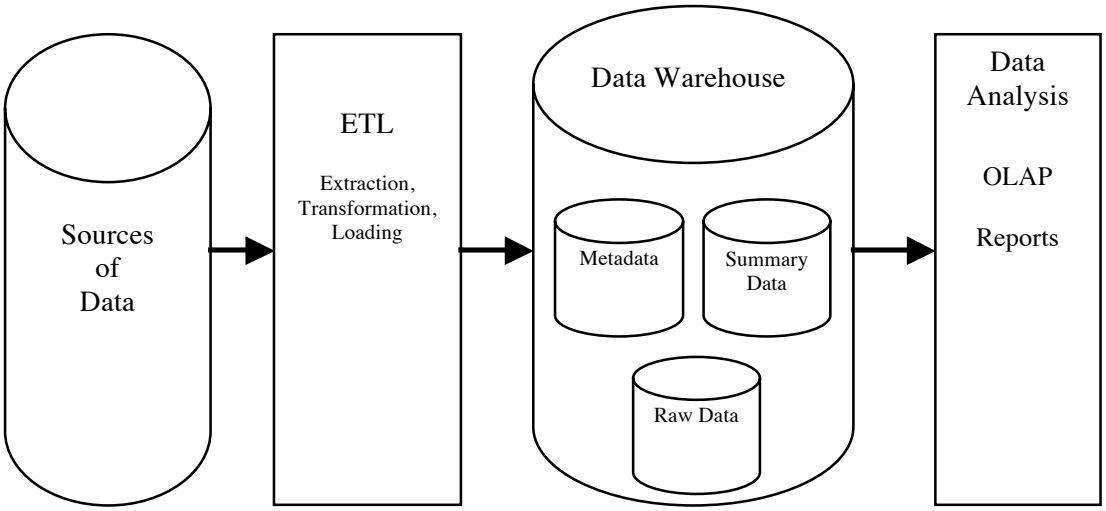


Fig. 2. Data Warehouse Development Process

Identification of sources and their types. The first step towards DW development is the identification of data sources. Usually, the sources are

1 https://www.mysql.com/
2 http://community.pentaho.com/projects/data-integration/
3 http://community.pentaho.com/projects/mondrian/

differentiated according to the mean of storage and the way that they are accessed. Each source, has its individual storage system and a different level of data quality.

ETL (extract, transform, and load) is a set of processes for getting data from several sources, such as OLTP systems, websites, flat files, e-mail databases, spreadsheets, and personal databases, such as Access, into a data warehouse. ETL is also used for loading data marts, generating spreadsheets, scoring customers using data mining models, or even loading forecasts back into OLTP systems. The main ETL steps, can be grouped into three sections:

- **Extract**: All processing required to connect to various data sources, extract the data from these data sources, and make the data available to the subsequent processing steps.
- **Transform**: Any function applied to the extracted data between the extraction from sources and loading into targets. These functions can contain the following operations:
    - Movement of data
    - Validation of data against data quality rules
    - Modification of the content or structure of the data
    - Integration of the data with data from other sources
    - Calculation of derived or aggregated values based on processed data
- **Load**: All processing required to load the data in a target system. This part of the process consists of a lot more than just bulk loading transformed data into a target table. Parts of the loading process include, for instance, surrogate key management and dimension table management.

Collection of large data volumes are a challenge. Extracting all the data from the source systems every time an ETL job is running is not feasible in most circumstances. Therefore there is a need to resolve the issue of identifying what has changed in source systems to be able to retrieve only the data that has been inserted, updated, or deleted. In some cases, this issue cannot be gracefully resolved and a brute force approach needs to be taken that compares the full source data set to the existing data set in the data warehouse.

Other challenges have to do with the way the data needs to be integrated; suppose there are many different systems where statistical data is stored, and the information in these systems is inconsistent or conflicting? How incomplete, inconsistent, or missing data are handled and compiled into a single DW ?

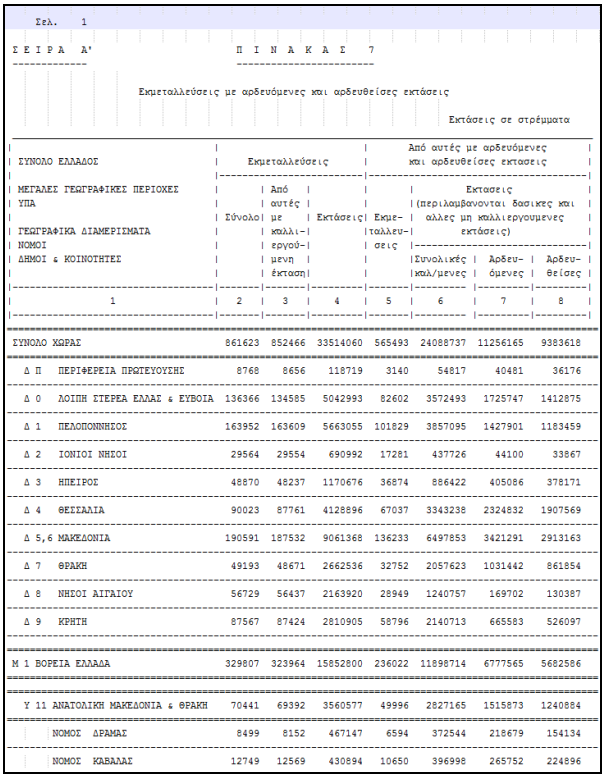
4 A Short Case Study on Greek Agriculture

The sources of statistical information for the Greek agriculture have been compiled on Table 1. The main provider is Hellenic Statistical Authority (EL.STAT) but the Farm Accountancy Data Network (FADN/RICA) is also an important source for microeconomic data on economic activity of farms, though this is limited to a specific range of farm sizes.

Ideally a Greek Agricultural Data Warehouse would use both sources to compile a single Data Warehouse. Such a DW would contain the following dimensions:

Administrative; Temporal; Agricultural Activity (nomenclature) and several different measures, while the OLAP cubes could be divided to themes like technical, economic, environmental, etc. There would also be the need for transforming the information, aligning where possible the granularity of time and space dimensions and also attaching the agricultural activity dimension. A discussion on dealing with such issues is made on Nilakanta et al. (2008).

Here we present a short proof-of-concept case where two tables of the Greek Census of Agricultural and Livestock Holdings (Agr.CENSUS) were parsed, transformed and imported to a DW and simple OLAP cubes were created using free-license tools.



Σελ. 1

Σ Ε Ι Ρ Α Α' Π Ι Ν Α Κ Α Σ 7

Εκμεταλλεύσεις με αρδευόμενες και αρδευθείσες εκτάσεις

Εκτάσεις σε στρέμματα

ΣΥΝΟΛΟ ΕΛΛΑΔΟΣ / ΜΕΓΑΛΕΣ ΓΕΩΓΡΑΦΙΚΕΣ ΠΕΡΙΟΧΕΣ / ΥΠΑ / ΓΕΩΓΡΑΦΙΚΑ ΔΙΑΜΕΡΙΣΜΑΤΑ / ΝΟΜΟΙ / ΔΗΜΟΙ & ΚΟΙΝΟΤΗΤΕΣ	Εκμεταλλεύσεις: Σύνολο	Από αυτές με καλλιεργούμενη έκταση	Εκτάσεις	Από αυτές με αρδευόμενες και αρδευθείσες εκτάσεις: Εκμεταλλευσεις	Εκτασεις (περιλαμβάνονται βασικες και αλλες μη καλλιεργουμενες εκτάσεις): Συνολικές καλ/μενες	Αρδευόμενες	Αρδευθείσες
1	2	3	4	5	6	7	8
ΣΥΝΟΛΟ ΧΩΡΑΣ	861623	852466	33514060	565493	24088737	11256165	9383618
Δ Π ΠΕΡΙΦΕΡΕΙΑ ΠΡΩΤΕΥΟΥΣΗΣ	8768	8656	118719	3140	54817	40481	36176
Δ 0 ΛΟΙΠΗ ΣΤΕΡΕΑ ΕΛΛΑΔ & ΕΥΒΟΙΑ	136366	134585	5042993	82602	3572493	1725747	1412875
Δ 1 ΠΕΛΟΠΟΝΝΗΣΟΣ	163952	163609	5663055	101829	3857095	1427901	1183459
Δ 2 ΙΟΝΙΟΙ ΝΗΣΟΙ	29564	29554	690992	17281	437726	44100	33867
Δ 3 ΗΠΕΙΡΟΣ	48870	48237	1170676	36874	886422	405086	378171
Δ 4 ΘΕΣΣΑΛΙΑ	90023	87761	4128896	67037	3343238	2324832	1907569
Δ 5,6 ΜΑΚΕΔΟΝΙΑ	190591	187532	9061368	136233	6497853	3421291	2913163
Δ 7 ΘΡΑΚΗ	49193	48671	2662536	32752	2057623	1031442	861854
Δ 8 ΝΗΣΟΙ ΑΙΓΑΙΟΥ	56729	56437	2163920	28949	1240757	169702	130387
Δ 9 ΚΡΗΤΗ	87567	87424	2810905	58796	2140713	665583	526097
Μ 1 ΒΟΡΕΙΑ ΕΛΛΑΔΑ	329807	323964	15852800	236022	11898714	6777565	5682586
Υ 11 ΑΝΑΤΟΛΙΚΗ ΜΑΚΕΔΟΝΙΑ & ΘΡΑΚΗ	70441	69392	3560577	49996	2827165	1515873	1240884
ΝΟΜΟΣ ΔΡΑΜΑΣ	8499	8152	467147	6594	372544	218679	154134
ΝΟΜΟΣ ΚΑΒΑΛΑΣ	12749	12569	430894	10650	396998	265752	224896

Fig. 3. Raw data format

The Agr.CENSUS is taking place from 1961 every 10 years. We focused on 1991 and 2000 censuses and on data related to grain crops (soft wheat, durum wheat, etc,. table 7B). The first task was to find the source data. The EL.STAT website does not provide the census data in a real database format. One can download the report of the data in pdf format (1991, scanned and bad quality). We received the data of the census after contacting the corresponding EL.STAT office but again those data were not really database data, requiring us to spend time on transforming data to a processable format. Without any knowledge of the underlying IT infrastructure of EL.STAT, it is necessary that the data provided to the public is in a database format.

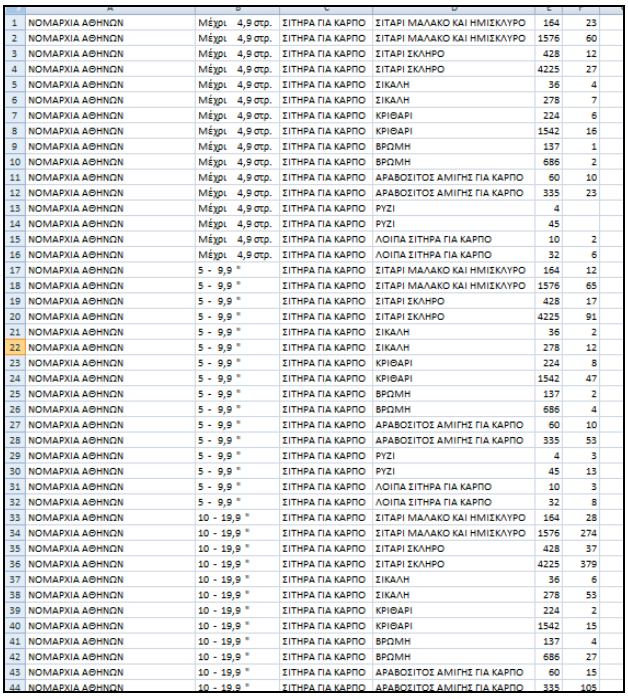
Table 1. Sources of statistical information for Greek Agriculture

Provider	Data Series Name	Type	Starting Year	Frequency	Geographical Coverage	Finest Geographical Resolution	Data Included	Data Availability
EL.STAT.[1]	Census of Agricultural and Livestock Holdings	Census	1961	every 10 years	Whole of Greece	Municipal districts	number of plant and animal agricultural holdings and their properties regarding their legal status, agricultural land tenure status, structural properties (type of crops / animal / activity), production methods	1961,1971,1981,1991 in printed form 2000,2009 in electronic form
EL.STAT.	Annual Agricultural Statistical Survey	Survey	1961	Annual	Whole of Greece	Municipalities (as defined in the "Kapodistrias" law)	agricultural utilized land per type of crop, volume of agricultural (plant and animal) production, utilization of agricultural machineries	Online from 1961 – 2006
EL.STAT.	Farm Structure Survey	Survey	1966	1966, 1977, since 1983 every 2 years (but not 1991 and 2000), since 2010 every 3 years	Whole of Greece	Municipal districts	number of plant and animal agricultural holdings and their properties regarding their legal status, agricultural land tenure status, structural properties (type of crops / animal / activity), production methods	Online since 2003
EL.STAT.	Survey on Crop Production (inclung permanent cultivations and grapeyards)	Survey		Grapeyards:Yearly survey , grains and other crops / Basic survey every 10 years for grapeyards / research every 5 years for permanent cultivations	Whole of Greece	Prefecture (NUTS-2)	Cultivating area per crop	Online since 2000

Provider	Data Series Name	Type	Starting Year	Frequency	Geographical Coverage	Finest Geographical Resolution	Data Included	Data Availability
EL.STAT.	Agriculture Input and Output Price Index	Index	1967	Monthly	Whole of Greece	760 (output) and 783 (input) price-collection-points, from all Greece	Index of output prices (subsidies and transport costs are excluded) for plant and animal products (as classified in European Economic Accounts) Index of input (products and services) prices	Online since 2001
EL.STAT.	Agriculture production factors' index (Cost Index)	Index	1975	Yearly	Whole of Greece	Whole of Greece / 155 points of price collection points	Index of production factor wage. It is comprised of three sub-indexes: labor (payment for one day), land (rent), and capital (loan interests and agricultural machinery rent)	Online since 2005
EU / MINAGRIC	FADN / RICA	Survey		Annual			Accountancy data	Fine detailed data is not freely distributed. Aggregated data is publicly available.
EUROSTAT	TRADE Database (COMEXT)	Detailed Data	1976	1976 – 1987 is annual, since 1988 is monthly	Whole of Europe	Intra is from direct collection of information from trade operators / Extra is from custom declarations	Value and quantity of goods traded between EU Member States (intra-EU trade) and between Member States and non-EU countries (extra-EU trade)	Since 2004 are free of charge http://ec.europa.eu/eurostat/web/international-trade/data/database

[1] Hellenic Statistical Authority (EL.STAT.)

The raw data received from the statistical office is shown in Fig 3. In order to transform the data to something manageable we pre-processed the tables with regular expression patterns in order to remove non-data characters (like dashes) and then converted the tables to records. The transformed data format is shown in Fig. 4.



1	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	Μέχρι 4,9 στρ.	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΣΙΤΑΡΙ ΜΑΛΑΚΟ ΚΑΙ ΗΜΙΣΚΛΥΡΟ	164	23
2	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	Μέχρι 4,9 στρ.	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΣΙΤΑΡΙ ΜΑΛΑΚΟ ΚΑΙ ΗΜΙΣΚΛΥΡΟ	1576	60
3	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	Μέχρι 4,9 στρ.	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΣΙΤΑΡΙ ΣΚΛΗΡΟ	428	12
4	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	Μέχρι 4,9 στρ.	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΣΙΤΑΡΙ ΣΚΛΗΡΟ	4225	27
5	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	Μέχρι 4,9 στρ.	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΣΙΚΑΛΗ	36	4
6	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	Μέχρι 4,9 στρ.	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΣΙΚΑΛΗ	278	7
7	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	Μέχρι 4,9 στρ.	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΚΡΙΘΑΡΙ	224	6
8	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	Μέχρι 4,9 στρ.	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΚΡΙΘΑΡΙ	1542	16
9	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	Μέχρι 4,9 στρ.	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΒΡΩΜΗ	137	1
10	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	Μέχρι 4,9 στρ.	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΒΡΩΜΗ	686	2
11	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	Μέχρι 4,9 στρ.	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΑΡΑΒΟΣΙΤΟΣ ΑΜΙΓΗΣ ΓΙΑ ΚΑΡΠΟ	60	10
12	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	Μέχρι 4,9 στρ.	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΑΡΑΒΟΣΙΤΟΣ ΑΜΙΓΗΣ ΓΙΑ ΚΑΡΠΟ	335	23
13	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	Μέχρι 4,9 στρ.	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΡΥΖΙ	4	
14	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	Μέχρι 4,9 στρ.	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΡΥΖΙ	45	
15	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	Μέχρι 4,9 στρ.	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΛΟΙΠΑ ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	10	2
16	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	Μέχρι 4,9 στρ.	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΛΟΙΠΑ ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	32	6
17	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	5 - 9,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΣΙΤΑΡΙ ΜΑΛΑΚΟ ΚΑΙ ΗΜΙΣΚΛΥΡΟ	164	12
18	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	5 - 9,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΣΙΤΑΡΙ ΜΑΛΑΚΟ ΚΑΙ ΗΜΙΣΚΛΥΡΟ	1576	65
19	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	5 - 9,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΣΙΤΑΡΙ ΣΚΛΗΡΟ	428	17
20	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	5 - 9,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΣΙΤΑΡΙ ΣΚΛΗΡΟ	4225	91
21	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	5 - 9,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΣΙΚΑΛΗ	36	2
22	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	5 - 9,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΣΙΚΑΛΗ	278	12
23	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	5 - 9,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΚΡΙΘΑΡΙ	224	8
24	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	5 - 9,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΚΡΙΘΑΡΙ	1542	47
25	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	5 - 9,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΒΡΩΜΗ	137	2
26	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	5 - 9,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΒΡΩΜΗ	686	4
27	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	5 - 9,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΑΡΑΒΟΣΙΤΟΣ ΑΜΙΓΗΣ ΓΙΑ ΚΑΡΠΟ	60	10
28	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	5 - 9,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΑΡΑΒΟΣΙΤΟΣ ΑΜΙΓΗΣ ΓΙΑ ΚΑΡΠΟ	335	53
29	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	5 - 9,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΡΥΖΙ	4	3
30	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	5 - 9,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΡΥΖΙ	45	13
31	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	5 - 9,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΛΟΙΠΑ ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	10	3
32	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	5 - 9,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΛΟΙΠΑ ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	32	8
33	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	10 - 19,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΣΙΤΑΡΙ ΜΑΛΑΚΟ ΚΑΙ ΗΜΙΣΚΛΥΡΟ	164	28
34	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	10 - 19,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΣΙΤΑΡΙ ΜΑΛΑΚΟ ΚΑΙ ΗΜΙΣΚΛΥΡΟ	1576	274
35	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	10 - 19,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΣΙΤΑΡΙ ΣΚΛΗΡΟ	428	37
36	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	10 - 19,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΣΙΤΑΡΙ ΣΚΛΗΡΟ	4225	379
37	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	10 - 19,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΣΙΚΑΛΗ	36	6
38	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	10 - 19,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΣΙΚΑΛΗ	278	53
39	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	10 - 19,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΚΡΙΘΑΡΙ	224	2
40	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	10 - 19,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΚΡΙΘΑΡΙ	1542	15
41	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	10 - 19,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΒΡΩΜΗ	137	4
42	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	10 - 19,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΒΡΩΜΗ	686	27
43	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	10 - 19,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΑΡΑΒΟΣΙΤΟΣ ΑΜΙΓΗΣ ΓΙΑ ΚΑΡΠΟ	60	15
44	ΝΟΜΑΡΧΙΑ ΑΘΗΝΩΝ	10 - 19,9 "	ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	ΑΡΑΒΟΣΙΤΟΣ ΑΜΙΓΗΣ ΓΙΑ ΚΑΡΠΟ	335	105

Fig. 4. Record-format data

Fig.5 and Fig. 6. present two reports coming from the same OLAP cube. The cube has been created using the star schema of Fig. 1. Following this schema, the OLAP cube has been constructed with four dimensions and two measures. Two of the dimensions are flat. The *time* dimension contains only the year corresponding to the data and the *size* dimension represents the different sizes (in hectares) of agricultural holdings, from which the measures are coming. The other two dimensions are hierarchical. The *administrative* dimension contains the regions and the prefectures in each region and the *product* dimension contains the category and the crops in each category. The measures contained into the cube are the number of agricultural holdings and the cultivated area.

Using the appropriate queries to the DW, in a specialized language, it is possible to filter the data according the dimensions and reorder them in any desired manner. The report of Fig.5 shows the cultivated area of several crops for some of the regions and Fig.6 shows the cultivated area for a specific crop for some regions and several holding sizes. What is interesting, with OLAP analysis, is that all these different analyses are accomplished using the same cube and the same set of data.

	Measures				
	Areas				
	Administrative				
Product	−All Administratives	+Περιφέρεια Ανατολικής Μακεδονίας & Θράκης	+Περιφέρεια Δυτικής Ελλάδας	+Περιφέρεια Δυτικής Μακεδονίας	+Περιφέρεια Θεσσαλίας
ΣΙΤΑΡΙ ΣΚΛΗΡΟ	11,743,728	1,688,125	134,021	1,185,269	1,921,813
ΑΡΑΒΟΣΙΤΟΣ - ΚΑΡΠΟΣ (ΑΜΙΓΗΣ)	3,666,133	1,154,703	605,947	301,510	368,990
ΣΙΤΑΡΙ ΜΑΛΑΚΟ ΚΑΙ ΗΜΙΣΚΛΗΡΟ	3,148,095	480,693	64,121	1,206,374	294,845
ΚΡΙΘΑΡΙ	1,959,958	202,347	179,768	413,645	286,002
ΒΡΩΜΗ	1,216,355	13,127	605,257	4,773	45,194
ΡΥΖΙ	389,418	11,198	13,621	102	915
ΣΙΚΑΛΗ	383,703	22,075	3,297	215,532	26,467
ΛΟΙΠΑ ΣΙΤΗΡΑ ΓΙΑ ΚΑΡΠΟ	49,837	7,515	10,551	1,630	7,986

Fig. 5. Example Report 1 of OLAP Cube

		Measures			
		Areas			
			Size		
Administrative	Product	−All Sizes	1 (Μέχρι 4,9)	2 (5 - 9,9)	3 (10 - 19,9)
−All Administratives	ΑΡΑΒΟΣΙΤΟΣ - ΚΑΡΠΟΣ (ΑΜΙΓΗΣ)	3,666,133	107,728	271,567	592,356
+Περιφέρεια Ανατολικής Μακεδονίας & Θράκης	ΑΡΑΒΟΣΙΤΟΣ - ΚΑΡΠΟΣ (ΑΜΙΓΗΣ)	1,154,703	13,578	38,481	108,178
+Περιφέρεια Δυτικής Ελλάδας	ΑΡΑΒΟΣΙΤΟΣ - ΚΑΡΠΟΣ (ΑΜΙΓΗΣ)	605,947	17,789	50,041	124,096
+Περιφέρεια Δυτικής Μακεδονίας	ΑΡΑΒΟΣΙΤΟΣ - ΚΑΡΠΟΣ (ΑΜΙΓΗΣ)	301,510	4,040	11,833	27,063
+Περιφέρεια Θεσσαλίας	ΑΡΑΒΟΣΙΤΟΣ - ΚΑΡΠΟΣ (ΑΜΙΓΗΣ)	368,990	13,784	37,815	81,954
+Περιφέρεια Κεντρικής Μακεδονίας	ΑΡΑΒΟΣΙΤΟΣ - ΚΑΡΠΟΣ (ΑΜΙΓΗΣ)	772,332	16,541	71,658	155,144
+Περιφέρεια Στερεάς Ελλάδας	ΑΡΑΒΟΣΙΤΟΣ - ΚΑΡΠΟΣ (ΑΜΙΓΗΣ)	102,659	9,028	13,278	25,703

Fig. 6. Example Report 2 of OLAP Cube

5 Conclusions

Statistical data for agricultural policy analysis has certain unique features: a multitude of sources of very different nature; a variety of dimensional granularity; different end user requirements. The utilization of Data Warehouse technology would be valuable for overcoming the above data issues.

The first step towards this direction is the detailed reporting of all of the available sources, their properties (dimensions, measures, etc.) and of their availability format. Afterwards the star schema of the DW has to be crafted, containing the required dimensions taking also into account the end-user requirements. Finally the ETL process has to be designed and implemented in order to load data into the DW. There are several license-free tools, making the whole process cost-effective. We followed the above path and made a mini case study for the Greek Agricultural Data. Certain conclusions are coming out.

Primarily the quality of the EL.STAT distributed agricultural data should be vastly improved. Either a DW approach should be incorporated for handling their source data or if this is already the case an OLAP application should go online for disseminating processed information. Also it seems that some of the EL.STAT early historical agricultural data are not available at all in electronic format, which also hardens their handling from researchers.

Secondly, for creating a Greek agricultural DW, the design of the star schema will not be a straightforward process. There are several issues that should be resolved. The administrative division of the Greek territory has changed more than a couple of times and the designer has to align all inter-temporal differences. In order for the OLAP extracted data to be consistent with Eurostat standards, additional information has to be incorporated, like NUTS-to-administrative units mapping and alignment with agricultural activity nomenclature.

Another important issue is the integration of different levels of data detail in the DW. All data sources are referring to some kind of administrative unit and to a specific kind of agricultural activity, and those two could be the connecting element. Micro-level farm data (e.g. the cost of production collected from FADN) could be presented next to more low granular data (e.g. area of a certain cultivation) if those two dimensions were consistent across data sources.

Finally the use of OLAP cubes and Web Services is very important for the usability of the DW. For instance, an agricultural policy model could use a Web Service directly instead of maintaining its own database.

As far as the future work is concerned, the need for a more expanded case study is evident. The consolidation of data from Farm Structural Surveys, Farm Census and FADN data will be very useful to agricultural policy modelers. From the diversity of those data sources will, probably, arise the issues of dimension integration and conflicting or missing data which will have to be addressed.

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KisanVikas – Android Based ICT Solution in Indian Agriculture to Assist Farmers

Arpit Narechania[1]

[1]BTech Final Year Mechanical Engineering, Indian Institute of Technology Mandi, H.P., India, e-mail: arpitnarechania@gmail.com

Abstract. Agriculture accounts for ~15% of the Gross Domestic Product (GDP) of India but employs close to 50% of the working population. Average yield in India is quite low compared to other countries. Advances in Information and Communication Technology (ICT) and the government initiatives in e-governance are only promoting e-agriculture in India. This can not only improve the condition of Indian agriculture but also the life and working conditions of the farmers. This paper proposes KisanVikas (Farmer Development), a mobile application, using ICT and promoting e-governance by provide continuous information pertaining to agriculture- weather forecast, crop prices, news, government helplines, and an inventory database manager. The mobile application also connects to an Arduino based wireless sensor network (WSN) comprising soil moisture, pH and temperature sensors to control water pumps for watering small fields, irrigation over the Global System for Mobile communication (GSM) and Bluetooth networks.

Keywords: e-agriculture, ICT, (WSN) wireless sensor networks, mobile application, android

1 1ntroduction

Agriculture, "The backbone of Indian economy" as quoted by MK Gandhi is defined as an integrated system of techniques to control the growth and harvesting of animal and vegetables. It is an uncomplicated endeavor comprising of technical and practical processes that helps in the maintenance of the ecological balance and protects human resources; most importantly it is a viable food production system (Agro Products 2015). In 2012-13 agriculture contributed to 13.9% of the total GDP (Economic Survey & CSO 2014, p. 23), and employed 47% of the total workforce population (World Bank 2014). The combined efforts of Central Government, State Governments and the farming community have succeeded in achieving a record production of 264 MT of food grains during 2013-14 (Economic Survey & CSO 2014, p. 19). This record production has been achieved through effective transfer of latest crop production technologies to farmers under various crop development schemes being implemented by the Department of Agriculture & Cooperation backed by remunerative prices for various crops through enhanced minimum support prices.

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As Indian economy has diversified and grown, agriculture's contribution to GDP has steadily declined from 1951 to 2014, yet it is still the largest employment source and a significant piece of the overall socio-economic development of India. Crop yield per unit area of all crops have grown since 1950, due to the special emphasis placed on agriculture in the five-year plans and steady improvements in irrigation, technology, application of modern agricultural practices and provision of agricultural credit and subsidies since the Green Revolution in India. However, international comparisons reveal the average yield in India is generally 30% to 50% of the highest average yield in the world (Economy of India 2014).

There are 38 crore mobile telephones in rural areas, 9 crore farm households and Internet penetration is currently at 5% but improving (TRAI, GoI 2014). Rural India leads a record 35% surge in use of e-governance. Of the 3.5 billion electronic transactions reported in 2014, 50% of them were from rural areas, which were responsible for only 20% of e-transactions in 2013 (Patil, 2015). This increasing penetration of mobile networks in India therefore presents an opportunity to make useful information more widely available. This could help agricultural markets operate more efficiently, and overcome some of the hurdles faced by it.

Mobile or smart phones are becoming an essential device for all types of users irrespective of the age group. High resolution cameras, high definition video with huge amount of memory; internet browsing through your handset and 3G and Wireless LAN connectivity; hardware like GPS, accelerometers, gyroscopes, Bluetooth are common to find on smart phones these days. Android, the open-source mobile operating system developed by Google, is quickly becoming the smart phone operating system choice for all. As of June'14 there were 57,380,000+ Google Android and 4,854,000+ Apple iOS users in India [Webenza Survey 2014].

The Ministry of Agriculture, Govt. of India, started various schemes in the interests of the farmers for mobile phones. The mKisan Portal (Ministry of Agriculture, GoI 2014) inaugurated in July'13 by Honorable President of India has received as of 1,85,40,07,285 messages, 5,74,40,63,746 and 237,777 advises as of 8th April'15. The weekly/ daily stock availability with dealers of seeds and fertilizers was made available at Rs. 5/month/dealer. USSD (Unstructured Supplementary Service Data), IVRS (Interactive Voice Response System) and Pull SMS provide broadcast messages – to get web based services on mobile without internet, in their language and voice messages for the illiterate. Based on NSS (National Sample Survey Organization) 59th Round Survey (cited by Singhal, Verma & Shukla 2011) the information regarding seeds was the most inquired information followed by the *mandi* (market) prices by the farmers. Based on the survey, the most important requirements of the farmers were divided into 3 broad categories -know-how about seed varieties to use; contextual information for weather, local soil conditions; and market information about commodity prices.

According to Saravanan R. (2014), there are many mobile advisory services in India, both by private as well as public sectors. Most of these are however regional services offered by the state governments directly or by the center for a particular region. Because of this, there is not only discontinuity in services across the nation but also a language barrier for out-of-state people.

Some initiatives in the public sector are Kissan Helpline (Farmer helpline), Mandi on Mobile Service by BSNL, Kissan Kerala, vKVK (Virtual KrishiVigyan Kendra),

and Mobile based Agro-Advisory System in North-East India (m4agriNEI). Private sector services include Fasal (crop), Awaaz de (voice it), Videokheti (video farming), Mandi Bhav (market price).

Extensive research has taken place in this field of using information and communication technology for agricultural purposes. Prabhakar, Jamadagni, & Sudhangathan, (2013) write about a 'datamule' which captures data from sensors like soil moisture in the field and is communicated over WiFi network to a mobile phone. Wilton, Hans and Carlos (2014) propose a telemetry system to record soil moisture, temperature data and store into a database for future diagnosis. Ariff, and Ismail (2013) have proposed an android application to maintain a database of various information related to the livestock in the farm. Singhal, Verma, and Shukla (2011) have developed an android application which provides information in the form of crop prices, weather information, farmer loan schemes, etc. to the user.

2 Objectives

As discussed earlier, there is a need to exploit the advances in ICT to foster e-governance which is important as the farmers need to work in tandem with the government and take full advantage of the services provided by it. The proposed mobile application acts as a farmer's assistant in the field. It provides essential agriculture related information like government helplines, weather forecasts, news, mandi (market) prices of crops to the farmer. There is also an in-built database in which the farmer can keep a track of his inventories, harvests, seeds and fertilizer purchases, vehicles and equipment, etc. He can also document the crop cycle by taking snapshots of the map of the field (displayed within the app) at regular intervals. To reduce the amount of field work for the farmer the application also offers wireless switching on-off of pumps for watering, irrigating. Wireless sensor network of soil moisture sensor, soil pH sensor and soil temperature sensor is connected to an Arduino Mega 2560 microcontroller board. The android application controls the pumps over GSM network via SMS (which enables pump control over long distances) and Bluetooth (when in close proximity for real time diagnosis of the sensor readings). We shall next see each feature of the application in detail.

3 Software Features

1: Language support: The application is offered in 8 regional Indian languages namely Hindi, English, Marathi, Bengali, Urdu, Kannada, Tamil and Telugu. The user has to choose his preferred language as soon as the application is started.
2: Sign in and Registration: The app requires the user to sign up with his mobile number, a 4 digit numerical password. The user is verified by sending a SMS to this number (i.e. itself) and detecting it. Upon successful verification, the registration details are written through a PHP script and HTTP Client Server APIs into a MySQL database at a remote central server. The database table returns JSON data every time

the user attempts a sign in which is parsed to allow further access or not. The registration system architecture as well as the recorded user database table are shown in Figure 1.

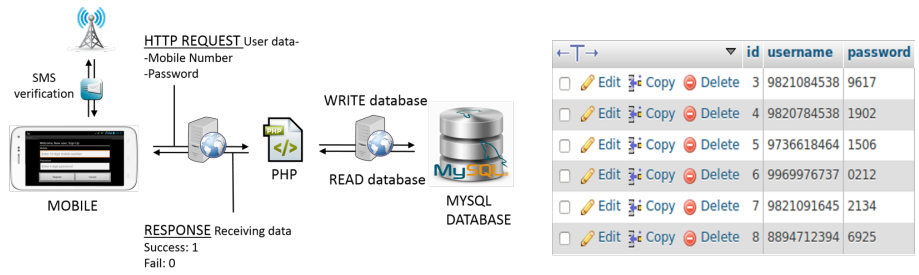


Fig. 1. Registration and Sign-in architecture

3: Weather Forecast: A HTTP Connection is made to the OpenWeatherMap Web service over WiFi/ GPRS which queries the data from servers. The data which the client gets regarding forecast is in the Extensible Markup Language (XML) and JavaScript Object Notation (JSON) formats. XML provides a language which can be used between different platforms and programming languages and still it can express complex messages and functions. JSON is used primarily to transmit human-readable text consisting of attribute–value pairs between a server and web application. Figure 2 shows the architecture of retrieving information as well as the weather data, which is in the form of XML and is parsed before being displayed in the application screen. User can search based on current GPS location or directly by city name; the 16 days' forecast includes information about – weather type, image, min-max temperature, pressure, wind speed, humidity, clouds; graphical trend over the next week of various parameters are also available in the app for visual aid [Figure 3]. These data will enable the farmer to better plan his actions during the agricultural cycle like taking precautionary measures over a predicted hailstorm, and hence safeguard his interests.

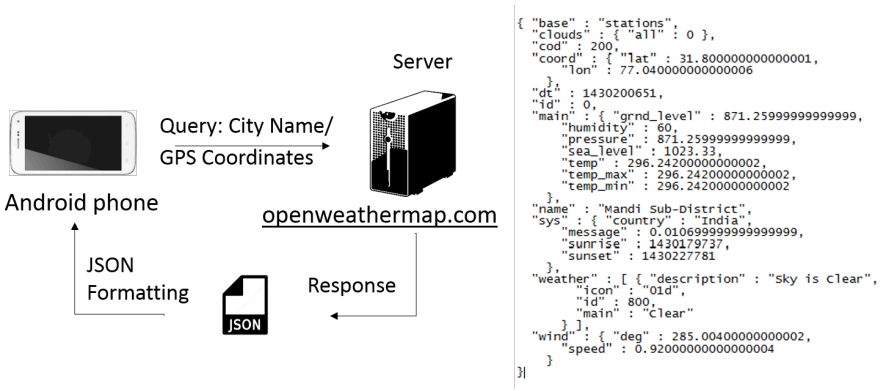


Fig. 2. Process of retrieving weather data from server; the response in JSON format

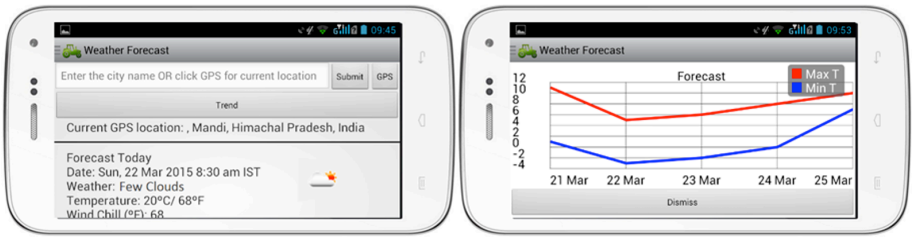


Fig. 3. Screenshots: various weather parameters; graph of min-max temperature

4: Commodity Market Prices: Agricultural commodities are traded in mandis (markets) at the district level. The government sets support prices to stabilize the prices but the Mandi prices are dynamic. The farmer, to access these prices enters the date, crop name and the Indian state. The application uses APIs provided by Open Government Data (OGD) – Platform India to make HTTP requests to the Agmarket Portal servers from where data in XML format is received, which, after formatting, is made available on the app in a human-readable form. The result table contains information about market (district name), arrival quantity (in MT), origin, variety, grade, minimum price, maximum price, and modal price (in Rs. / quintal) [Figure 4]. With a rough idea about the prices, the chances of a farmer being exploited and cheated are minimized.

Fig. 4. Process of retrieving crop prices from server; the app screenshot with results

5: Agricultural News: Keeping oneself updated about the happenings in and around the world is essential in taking precautions or planning for a better produce. An HTTP Connection is made to the database/ web server over WiFi/ GPRS which gets the data from AgriFeeds and indiaTogether websites. The data, in the form of RSS Feeds is parsed and then displayed in viewable form. News are obtained using RSS feeds on 82 topics globally, national (pertaining to India) or regional (state-wise news). Clicking on the headlines enables reading of the complete article [Figure 5].

Fig. 5. Screenshots: News headlines as a list; redirection to complete news article

6: Farm Manager (Inventory management): The application has an in-built farm manager module with which the user can better manage his field and crops. The farmer can keep a track of his assets, inventories and also his cropping cycle.
1: Vehicles and attachments – name, id, purchase date, cost, last, next servicing dates
2: harvested crops – name, quantity, harvest date, amount unsold and check date.
3: seeds and fertilizers - name, quantity, purchase date, cost, quantity remaining.
The app also generates alarms based on these dates to remind the farmer about upcoming servicing, maintenance dates. A SQLite database for android is used to manage (insert, edit, delete, view) the data. The SQLite database is exported to the more common Microsoft Excel format (.xlsx) using Android APIs [Figure 6].

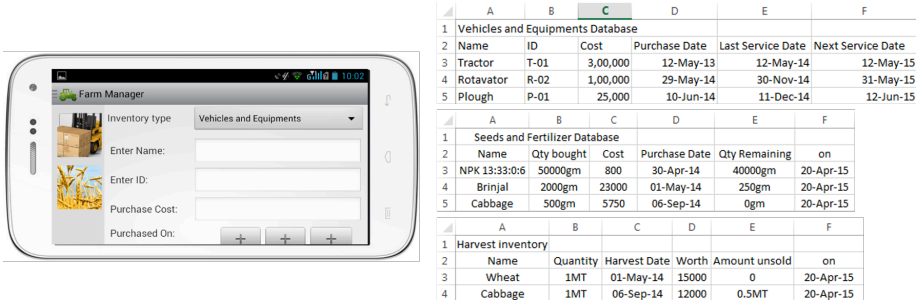


Fig. 6. App UI to insert data; snapshots of the databases into excel format

7: Map of Field: Google Maps V2.0 API was used to display the area around the farmer's current position (supposedly near his field). The map features the terrain, normal, marker only views. The farmer can insert any markers to mark his field boundary. There is also a map screenshot option to take timely snapshots during the crop cycle [Figure 7] to monitor his crop for healthy growth.

Fig. 7. Map of the farmer's field; list of snapshots of the field taken during the agricultural season

8: Farmer Helplines: As stated earlier, the Indian government comes up with time to time schemes and farmer assisting centers fostering e-governance. The Indian government has come up with Kisan Vikas Kendras (KVK), and Kisan Call Centres (KCC) as advisories to respond to issues raised by farmers instantly as well as continuously in their local languages. There is a toll free helpline of the KCC set up by the government at the farmers' disposal. The application provides the state wise addresses and contact information of the various KVKs and KCCs in the country.

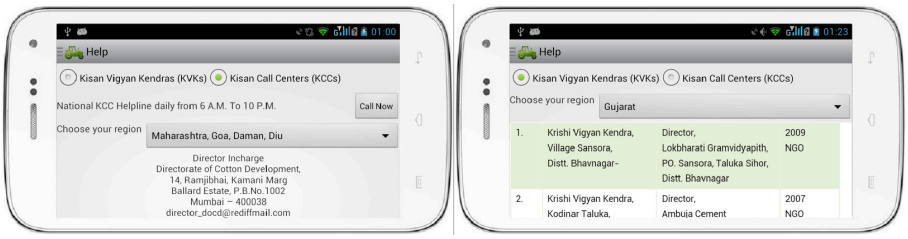


Fig. 8. Result of KCC contact information for Maharashtra, Goa, Daman, Diu region; Result of KVKs based in the state of Gujarat

4 Wireless Pump Operations

The mobile application is designed to establish a dual communication with an Arduino microcontroller controlled wireless sensor network and water pump. 2 types of wireless networks, namely GSM and Bluetooth [Figure 10], were used to establish this communication channel. 4 sensors measuring soil moisture, soil temperature, soil pH, and air humidity respectively are connected to the microcontroller and they send their data to the android application for diagnosis as well as appropriate decision making on operating the pumps. The system architecture is shown in Figure 9.

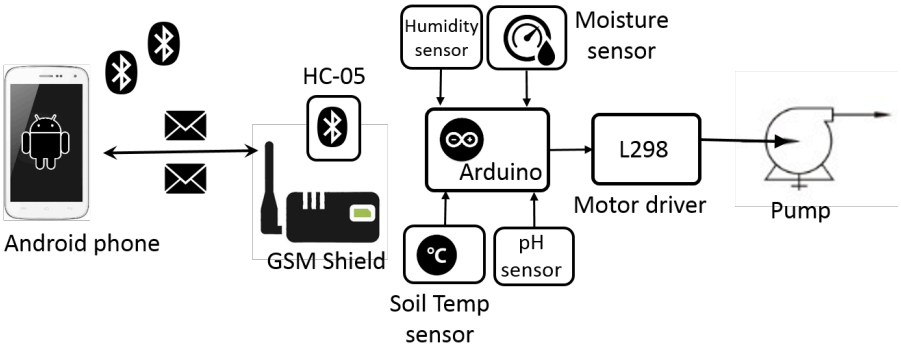


Fig. 9. Architecture of the mobile (android) - microcontroller (arduino) interface with the sensor-actuator networks.

- Over GSM: The merit of using this communication channel is that it can be operated over long distances too. An Arduino GSM shield with a SIM card was connected to the microcontroller and the wireless sensor network. The farmer queries for the status of the sensors before taking a decision. The SMS received from the microcontroller contains the current pump status and the sensor readings at that very instant. Taking stock of these readings farmer can remotely switch on-off the water pumps by setting the target soil moisture parameter. The pump will be switched ON till the farmer specified soil moisture value is reached.
- Over Bluetooth: When the farmer is at his field, he can directly connect the android application with the wireless pump system over Bluetooth. A HC-05 Bluetooth module was connected to the same microcontroller to establish a duplex communication channel between itself and the android smart phone. Data is encrypted, for example, into strings like <!“data”\n!> where “data” is the actual data for example – start; '<' is the start bit, '!' is the start confirm bit, ‘\n’ is the end of data bit. Similarly, '!' is the end bit and '>' is the end confirm bit. This encryption is necessary to avoid any noise (fuzzy data) collected by the sensors from the environment. For example: The string value for retrieving the sensor information is <!“57”,“69”,“24”,“8.2”\n!> which has the various sensor readings in the order of moisture, humidity, temperature and pH. Because this is a real time connection, there is continuous exchange of data at a high rate. The application records the sensor readings every 2 minutes and graphs all the sensor readings over time for diagnosis. The readings are also saved in a local sqlite database table only to be exported to the excel format later [Figure 11].

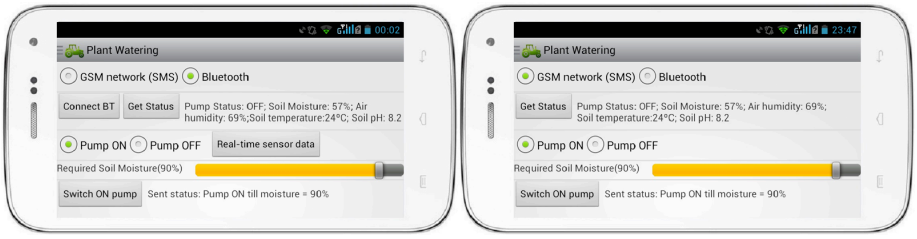
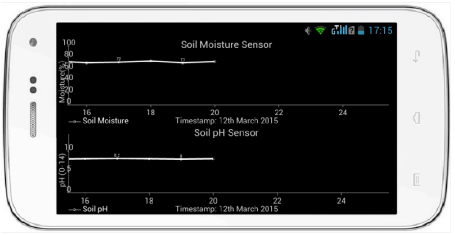


Fig. 10. Pump operations over GSM; Bluetooth



	A	B	C	D	E
1	Timestamp	Temperature (°C)	Humidity (%)	Soil Moisture (%)	Soil pH (0-14)
2	12-03-2015 11:00	28.2	54	74	8.1
3	12-03-2015 11:02	28.1	54	73	8.3
4	12-03-2015 11:04	28.1	52	73	8.1
5	12-03-2015 11:06	28.4	53	72	8.1
6	12-03-2015 11:08	28.3	56	73	8.2
7	12-03-2015 11:10	28.2	55	74	8.1
8	12-03-2015 11:12	28.5	56	72	8.2
9	12-03-2015 11:14	28.1	51	72	8.2
10	12-03-2015 11:16	28.5	53	72	8.2
11	12-03-2015 11:18	28.3	56	73	8.2
12	12-03-2015 11:20	28	56	72	8.2
13	12-03-2015 11:22	28.1	56	72	8.1
14	12-03-2015 11:24	28.1	55	74	8.2
15	12-03-2015 11:26	28.4	54	75	8.1
16	12-03-2015 11:28	27.9	57	74	8.1
17	12-03-2015 11:30	28.2	56	73	8.2

Fig. 11. Real time sensor data in a graph when connected over Bluetooth; sensor data tabulated every 2 minutes and exported into Microsoft Excel format

5 Conclusion

The mobile application was tested by some local residents of a village and they expressed an interest to really use the technology. The fact that it was also offered in multiple regional languages made it easier for them to learn its operation. An agricultural field setup was made on a table with soil all over. The small submersible pumps along with the moisture and pH sensors were put in a fixed place with a small container with mini pipes acting as the water tank. The mobile phone successfully switched the pumps on and off based on the moisture and other readings, thereby irrigating the field. The mobile application will truly serve as a great assistant to a farmer by providing continuous real time information as and when required. Productivity will increase and a farmer's time on field or going to nearby cities will considerably decrease. This ICT revolution promoting e-governance will lead to more enthusiasm among farmers fostering the need for more information for better decision making. In the long run, this will lead to overall development in India in the agricultural sector. The wireless sensor network system is to be made more robust and self-sufficient by installation of solar panels in the field and housing the electronic components in proper casings. More features providing information on availability of seeds and fertilizers, farmer loan and credit schemes will be incorporated into the application.

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Plant Disease Diagnosis Based on Image Processing, Appropriate for Mobile Phone Implementation

Nikos Petrellis[1]

[1]Department of Computer Science and Engineering, Technology Educational Institute of Thessaly, Greece, e-mail: npetrellis@teilar.gr

Abstract. A steady plant monitoring is necessary to control the spread of a disease but its cost may be high and as a result, the producers often skip critical preventive procedures to keep the production cost low. Although, official disease recognition is a responsibility of professional agriculturists, low cost observation and computational assisted diagnosis can effectively help in the recognition of a plant disease in its early stages. The most important symptoms of a disease such as lesions in the leaves, fruits, stems, etc, are visible. The features (color, area, number of spots) of these lesions can form significant decision criteria supplemented by other more expensive molecular analyses and tests that can follow. An image processing technique capable of recognizing the plant lesion features is described in this paper. The low complexity of this technique can allow its implementation on mobile phones. The achieved accuracy is higher than 90% according to the experimental results.

Keywords: plant disease, lesions, image processing, agricultural production.

1 Introduction

Plant diseases can increase the cost of agricultural production and may extend to total economic disaster of a producer if not cured appropriately at early stages. The producers need to monitor their crops and detect the first symptoms in order to prevent the spread of a plant disease, with low cost and save the major part of the production. Hiring professional agriculturists may not be affordable especially in remote isolated geographic regions. Machine vision can offer an alternative solution in plant monitoring and such an approach may anyway be controlled by a professional to offer his services with lower cost. Of course, there are several additional tests that have to be performed in order to confirm a specific disease but image processing can give a first clue on what really happens at the field.

Before focusing on the existing image processing techniques, the features of molecular tests are reviewed (Sankaran et al, 2010). Molecular test sensitivity depends on the minimum amount of microorganism that can be detected. For example, bacteria detection can range from 10 to 10^6 colony forming units per mL (Lopez et al, 2003). A popular molecular diagnosis method is the ELISA that is

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based on the use of a microbial protein associated with the plant disease. This protein is injected into an animal that produces antibodies that are extracted and used for antigen detection with fluorescence dyes and enzymes. PCR is another popular technique based on DNA analysis (Shaad and Frederick, 2002). Molecular tests require expensive equipment and samples may need to be transported to the premises where the tests can be performed, although portable low cost equipment has been recently presented capable of performing tests like PCR (Spathis et al, 2014).

The spectroscopic and imaging are non-destructive low cost techniques that can be used for plant disease diagnosis based on its symptoms. Spectroscopic techniques can also identify water stress levels and nutrient deficiency, measure the fruit quality after the harvest, etc. Spectroscopic techniques include fluorescence or multispectral imaging (Chaerle et al., 2007), infrared spectroscopy (Purcell et al, 2009), etc.

Reviews of image processing techniques in visual light for plant disease detection can be found in (Barbedo, 2013), (Camargo and Smith, 2009) and (Kulkarni and Patil, 2012). In (Kulkarni and Patil, 2012) an image segmentation takes place in the CIE L*a*b color scale, then a Gabor filter is used to generate the input of a neural network that achieves a disease recognition with a 91% accuracy. Other classification techniques take into consideration the shape, the texture, fractal dimensions, lacunarity, dispersion, grey levels, grey histogram discrimination and the Fourier descriptor.

Most of the image processing and spectroscopic techniques require the analysis to be performed by specialized equipment and software packages. In this paper, we focus on a low complexity image processing technique that can be implemented and installed on a mobile phone. The image processing technique described here, is developed in the framework of a plant disease recognition system that is under development. This system operates in multiple levels ranging from a single standalone mobile phone, to a mobile phone communicating with a cloud or database and cooperating with the portable DNA analysis equipment for complementary PCR-like tests (Spathis et al, 2014).

Although the color features are also important in the process of plant disease recognition we focus on three parameters of the lesions that can appear at the leaves, the stem, or the fruit of a plant: (a) the number of spots, (b) their area and (c) their gray level. The measurement of these three features can give a first indication on the condition of the plant. The proposed system called henceforth Spot Recognition System (SRS) can be easily extended to generate the Red-Green-Blue (RGB) features of the spots or their CIE L*a*b color scale as will be described in the following sections although this feature is not experimentally tested in the present work.

Having installed the software implementation of the described image processing technique on a mobile phone, the producer would be able to take pictures of plant parts with lesions, immediately analyze the photos and take any further action needed to confirm the potential disease and apply the recommended therapy.

In this paper we apply the proposed technique to tangerine tree leaves with lesions and measure the accuracy in the spot feature recognition. Such measurements could have been used to discriminate between sooty mold (fungal growth), citrus canker, scab, etc that can have affected a citrus tree. Experimental results show that the measurement of the number of spots, their gray level and area can be achieved with

higher than 90% accuracy. The proposed technique is a low complexity algorithm that does not rely on expensive or complicated image processing tools and thus can be easily implemented in Java or C to create an appropriate mobile phone application. The results of the proposed image processing technique can be used for example by a neural network or by a more deterministic rule-based decision system.

The plant disease recognition framework where the proposed image processing technique has been developed is described in Section 2. The implementation details of the SRS are given in Section 3 and experimental results are presented in Section 4.

2 Plant disease recognition framework

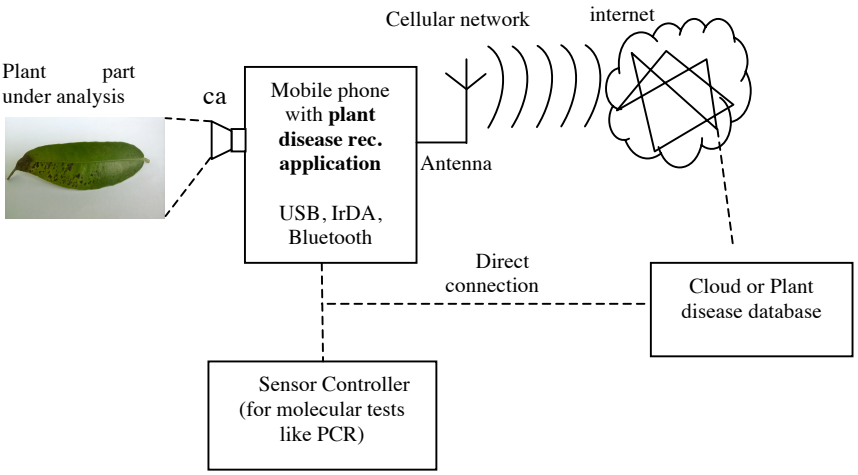

Fig. 1. The plant disease recognition framework under development.

The plant disease recognition framework under development is shown in Fig. 1. Its basic functionality operates on a single mobile phone equipped with a color camera with reasonable resolution. The mobile phone should be capable of connecting to the internet if a more detailed disease database or cloud has to be accessed. This may be required if the number of plants/diseases that can be examined is too high and the recognition rules, patterns and other data cannot be stored locally on the phone. Moreover, the storage of the pictures taken by the phone and the analysis results to the remote cloud or database can make easier their access by professional agriculturists.

The producer can use his phone with the installed plant disease recognition application when he wants to check the condition of the plants in his crops. He can take pictures of plant parts with lesions (e.g., leaves, stem, fruit) and run the plant disease recognition application on the pictures taken. The SRS of the plant disease recognition application extracts the lesion features like number of spots, grey level, area and these results are used by the decision module of the application that will extract a conclusion on the condition of the plant. As already mentioned the decision

module can be a neural network. If a more advanced decision module has to be used operating on a diversity of disease recognition rules and data, the output of the SRS can be simply sent through GPRS or the internet to an external database or cloud. If the phone is moved close to the computer where this external cloud or database is installed then, the SRS results can be transferred through a different communication method like Bluetooth, WiFi, IrDA, etc. The plant disease recognition application may also need additional information that can be retrieved from the telephone itself like for example temperature and moisture conditions (e.g., these can be retrieved by the internet after the localization of the user geographical position). Additional statistical information can be given by the user through a questionnaire shown to him by the application.

In a more advanced setup, the mobile phone can cooperate with a DNA analysis module like the biosensor readout circuit described in (Spathis et al, 2014) that has been developed for the Corallia/LabOnChip project. The communication with this module can be performed in a wired or wireless manner (USB, WiFi, Bluetooth, etc).

3 The developed Spot Recognition System

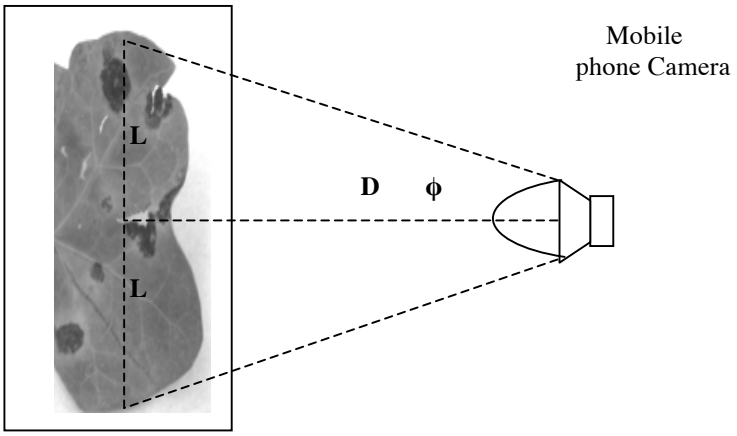

Fig. 2. Estimation of the leaf dimensions.

The Spot Recognition System (SRS) assumes that the picture of the plant part has been captured from as known distance *D* as shown in Fig. 2. The awareness of the distance *D* can be guaranteed if the user is ordered to take the picture from a roughly known distance e.g., related to his hand or to adjust the distance so that the plant part that will be captured fits the photograph. If the camera angle ϕ is also known then, the half leaf length is estimated by:

$$L=D \bullet \tan(\phi). \quad (1)$$

If the length L is known and it corresponds to P pixels then, the constant S can be used to estimate a distance from any other number of pixels:

$$S = \frac{L}{P} \tag{2}$$

For example, if two points in the horizontal axis, correspond to a real distance L' and the number of intermediate pixels is P' their distance L' is

$$L' = L\frac{P'}{P} \tag{3}$$

If the two points do not reside on the same axis, the same method can be used to estimate their distance and P' is the number of pixels between the two points in the diagonal line connecting them. In 2D, if the dimensions of the covered area are L_x, L_y in the x and y axis, corresponding to P_x and P_y pixels, then each pixel occupies an area A_p estimated as:

$$A_p = \frac{1}{S^2}\frac{L_x L_y}{P_x P_y} \tag{4}$$

A spot of any shape consisting with P_i pixels will correspond to an area: $P_i \bullet A_p$.

The next issue is how the spots and their features (dimensions, position, color or grey level features) will be recognized using a simple algorithm. First of all, the plant part should be separated by its background. This can be performed by a segmentation procedure that nevertheless is based on complicated operations or a dedicated image processing libraries. A simple method used in this work is to assume that the background is much brighter than the plant color. This can be easily reassured if for example a leaf is captured with a white sheet of paper as its background. The user's hand can also be used as a background in most cases if the plant part has a darker color.

Although, the three color components of an image (Red, Green, Blue) can be easily handled to extract detailed image features we focus on a grey scale characterization of the image components and the spot number, coordinates, area and darkness are the outputs of the SRS. Thus, the captured image is initially converted into an inverted grey image and the original pixels with high brightness (below a threshold T_w in the inverted grey image) are ignored since they are assumed to belong to the background. An average grey level A_g is estimated by the rest of the pixels that are assumed to belong to the plant part. Then, the image matrix is scanned to locate the pixels i with a grey level G_i such as:

$$\left|G_i - A_g\right| > T_h \tag{5}$$

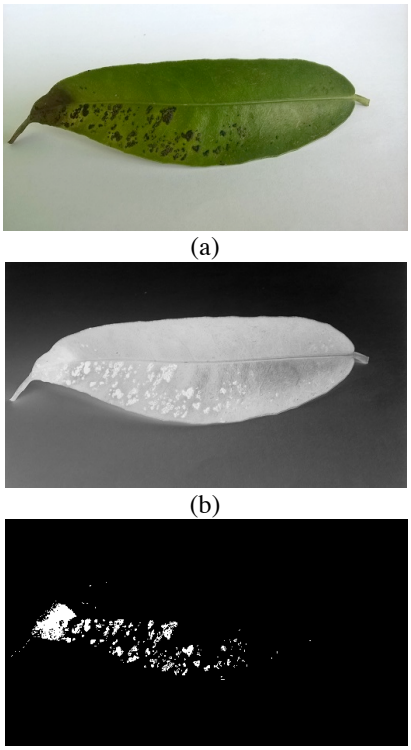

Fig. 3. Original photograph (a), in inverted grey level (b) and the visualization of BW1 with T_h=115 (c).

If the difference between the grey level of the pixel and the average is higher than the threshold T_h the specific pixel is assumed to belong to a spot (lesion) and a 0-1 matrix *BW1* (with the same dimensions as the original image) is constructed with 1's at the positions of pixels belonging to spots as shown in Fig. 3. The *BW1* is scanned again to group neighboring pixels belonging to the same spot. The resulting matrix *BW2* has an integer spot identity at the position of each pixel or 0 if the pixel does not belong to a spot. The *BW2* matrix is constructed using the following algorithm: a) the rows are scanned from left to right and neighboring pixels are assigned with the same identity, b) if the previous pixel on the left of the current one does not belong to a spot, the already visited neighboring pixels at the row above are checked and if one or more of these has been assigned to a spot identity, this identity is also used for the current pixel, c) the *BW2* matrix is scanned iteratively merging spot identities if neighboring spots are found with different identities until no change is detected. A filtering can also be applied discarding spots consisting of very few pixels (less than *MinArea*) because either they are noise or they are too small to be considered.

From the matrix *BW2* all of the desired features can be easily available: a) the maximum spot identity is the number of spots, b) area covered by the spots is

estimated using the sum of the pixels belonging to spots (see equation (4)), an interesting parameter is the fraction of the plant part that is occupied by spots, c) the average grey level of each spot, d) the coordinates of each spot and its dimensions.

More advanced information can also be extracted if the coordinates of each spot are used to visit the original colored image and extract the texture of a spot, information like CIE L*a*b (Kulkarni and Patil, 2012), etc.

4 Experimental Evaluation

In this section the SRS method described in the previous section is applied to the pictures of Fig. 3a and Fig. 4a. These images show tangerine leaves with dark spots that may indicate for example the fungus Capnodium oleae or CTV among other diseases. The number of spots and the area they occupy on the leaf are significant inputs for the decision module of the mobile disease recognition application described in Section 2. The SRS output for the photographs of Fig. 3 and 4 are listed in Table 1. The grey level is not displayed since it cannot be compared to a reference grey level. The best results were retrieved when setting T_h equal to 115. The parameter *MinArea* of Table 1 that is set to 4 represents the least number of pixels required to take into consideration a spot.

Table 1. SRS Measurement Result (MinArea=4, T_h=115).

Photo	Spots	Area	Spot Error	Area Error
Fig. 3	68	2.1%	-5.88%	+8%
Fig. 4	65	1%	-10%	-16%

The negative sign in the errors of Table 1 indicates that the estimated number of spots or area is smaller than the real ones. The errors concerning the number of spots and the estimated area are inversely proportional. This means that when changing the parameters T_h and *MinArea* to improve one error the other gets worse. Using the image of Fig. 4 and setting *MinArea=2*, the number of spots recognized is higher since smaller spots will also be taken into consideration. If T_h is also increased (e.g., set to 120), then spots with higher contrast are used and those with lower contrast compared to the leaf background are ignored. Consequently, the parameters T_h and *MinArea* balance somehow each other. Setting T_h to a very high or a low value may significantly reduce or increase the estimated spot area respectively. Using MinArea=2 and T_h=120 with Fig. 4 leads to the detection of 87 spots (error +20%) but the estimated spot area is only 0.2%. The conducted experiments show that the values 2 and 115 selected for the parameters *MinArea* and T_h respectively lead to the highest estimation accuracy.

Although the spot recognition method has been applied in two indicative leave images, a predictable accuracy can be obtained in other plant case studies if the spot density and brightness is similar.

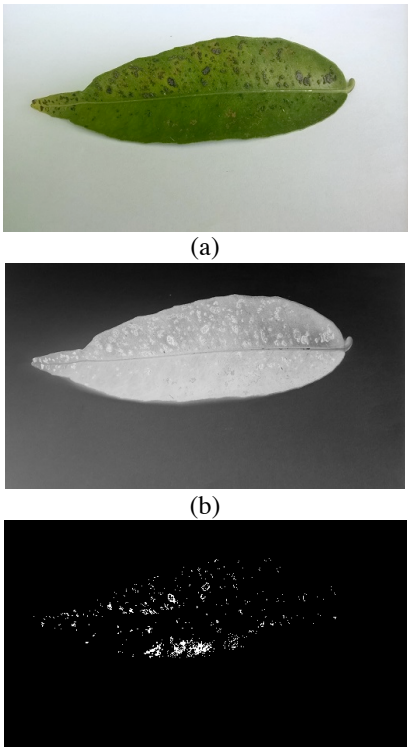

Fig. 4. Original photograph (a), in inverted grey level (b) and the visualization of BW1 with T_h=115 (c).

5 Conclusions

An image processing technique that can be easily implemented on smart phones, capable of recognizing plant lesion features has been presented. The preliminary measurement results in the recognition of the number of spots and their area on plant leaves showed accuracy higher than 90%.

In future work the color features of the recognized spots will also be taken into consideration for safer plant disease diagnosis and the presented algorithm will be implemented on smart phones and tested under outdoor conditions.

Acknowledgments. This work is protected by the provisional patent 1008484, published by the Greek Patent Office, May 12, 2015.

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ICT Enable of Agricultural Innovation Systems: Implications Environment, Population and Food Production

Dr. R. Heather Jaffan[1]

[1]12181 Hickory Knoll Place, Fairfax Virginia, USA 22033, e-mail: ejaffan@aol.com

Abstract. ICTs is ideally suited to enhance interaction between enterprises and individuals focused on bringing new products, new processes and new forms of organization into economic use, together with the institutions and policies that affected their behavior and performance. This Model recognizes that an interaction of people and ideas catalyzes innovation. And that technological advancements consist of generating, accessing utilizing and managing knowledge. To this end ICTs can expand communication cooperation and ultimately Innovation among the mushrooming assortment of actors in agriculture. This paper will demonstrate that ICTs especially mobile phone can and would drive participatory communication including consultation with those on the margins of traditional research-extension processes, and they are often the key instrument of organizations that used to deliver to larger number of rural people than they could reach before. Telecommunications networks have increased the speed, reliability, and accuracy of the potential of nanotechnology to revolutionize Information and communication technology, as well sustainable agricultural production via information exchange—through text, voice, and applications—between farmers and other stakeholders. Low-bandwidth networks have also started to trickle into rural areas in developing countries, creating opportunities for farmers to connect with extension workers, agribusiness, researchers, and each other.

Keywords: sustainable agriculture, mobile phone, cloud computing, advanced technology, food production, policy maker

1 Introduction

It is widely held believe that Smallholder farmers would be responsible for feeding the billion hungry populations. In his book 2012 "One billion Hungry: Can We Feed the World?" Sir Gordon Conway indicated that the many interrelated issues critical to our global food supply from the science of agricultural advances to the politics of food security.

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It is believed that 500 smallholders with less of 2 hectares of lands in sub-Saharan Africa and Asia are responsible for feeding one third of the World population. In Africa the dependence is higher, where small farms produce about 80% of the food consumed (Vittorio Calao, CEO Vodafone, "The Role of Mobile in Driving Efficacy and Sustainability in the Food and Agriculture Value Chain."

To achieve Global sustainable agriculture demands appropriate policies to foster open access to timely, cost-effective, innovations, research, advanced technologies and applied technology transfer, services and storage, essential information on market prices and Market Channels.

Understanding and addressing global agricultural developments-both positive and negative –are critical to improving smallholders' livelihoods. This paper presents a comprehensive review on Information Communication Technology (ICT) that can improve smallholder farmers' incomes, reduces water scarcity, decrease CO2 emission and increase agricultural productivities both in qualities and quantities

The Author will demonstrate that the prevailing, expanded and increasingly affordable connectivity and tools, especially mobile phones, as well as advances in data storage – Cloud Computing and open access, have made ICT significant ino Agricultural Production Systems. Mobile phone and wireless Internet end smallholders isolation therefore prove to be the most transformative Technology of economic and agricultural development of our time.

2 Sustainable Agriculture

Sustainability underlines the principle that we must meet the needs of the present without compromising the ability of future generations to meet their own needs. Therefore, stewardship of both natural and human resources is of prime importance. Managing and administrating human resources includes consideration of social responsibilities such as working and living conditions of laborers, the needs of rural communities, and consumer health and safety both in the present and the future. Governorship of land and natural resources involves maintaining or enhancing this vital resource base for the long term.

Sustainable agriculture interlaces three main goals--environmental health, economic profitability, and social & economic equity. A variety of philosophies, policies and practices have contributed to these goals. People in many different capacities, from farmers to consumers, have shared this vision and contributed to it. Despite the diversity of people and perspectives, the above themes commonly weave through definitions of sustainable agriculture.

Systematic methodology is essential to understanding sustainability. The system is envisioned in its broadest sense, from the individual farm, to the local ecosystem, and to communities affected by this farming system both locally and globally. An emphasis on the system allows a larger paradigms and more orderly understanding of the

consequences of farming practices on both human communities and the environment. A system approach gives us the tools to explore the interconnections between farming and other aspects of our environment. A system evaluation implies interdisciplinary efforts in research and education. This requires not only the input of researchers from various disciplines, but also farmers, farmworkers, consumers, policymakers and others stakeholders.

Transforming to sustainable agriculture is a process. For farmers, the transition to sustainable agriculture mandates a series of small, realistic steps. Family economics and personal goals and education influence how fast or how far participants can go in the transition. It is important to realize that each small decision can make a difference and contribute to advancing the entire system further on the "sustainable agriculture continuum." The key to moving forward is the will to take the next step.

The strategies for realizing sustainable agriculture are grouped according to three separate though related areas of concern: Farming and Natural Resources, Plant and Animal Production Practices, and the Economic, Social and Political Context. They represent a range of potential ideas for individuals committed to interpreting the vision of sustainable agriculture within their own circumstances.

3 Major Actors in Sustainable Agriculture

Policy Makers are critical decision makes in the process of sustainable agriculture. Policies makers must adopt policies that provide incentives to smallholders to practice sustainable agriculture. In addition, the policy makers must pave the roads to create appropriate technical infrastructure including building Institutional complexes and technical information centers, establishing appropriate educational & technical colleges and extension resources. Policies that provide; adequate energy, water supplies, transportation systems, and ports. Establish Incentive and balanced policy to promote imports & exports.

Multidisciplinary Researchers: An agricultural sector encompasses soft and hard sciences. Therefore researchers must collaborate in their efforts to bring about comprehensives advancements in agricultural sustainability.

Institution & Educators are the key in trickling down/trickling up information to and from the famers and smallholders.

Farmers and smallholders are the executive that implement and practices sustainable agriculture. They are major decision makers and their roles in developing and enduring sustainable agriculture s of paramount important.

Innovators: Smallholders and social actors actually do to innovate their practices can be understood as networking: social actors in search of relevant ideas, knowledge, information and experiences, continuously build and manage relationships with others which, by some standard, they consider relevant to innovating their practices

Investors: Agriculture is very risky investment. However, sustainable agriculture drives down risk factors.

Postharvest /Primary Processors and Packagers: Technological advancements are available to prevent postharvest loses. Protecting commodities at the farmgates preserve commodities quality and prolong its shelflife. As such it is significant value added

Transporters: Refrigerated and appropriately cooled trucks are are value added

Marketers & Traders, understanding market opportunities, and prices mechanisms both at the local and international level are crucial to increase income revenues and profits

And on the demand side is the Consumers that utilize the commodities.

Factors to be considered in Practicing Sustainable Agriculture:

Farming and Natural Resources, in Specific non Renewable resources:

water, (b) soils and (C) energy

2. Plant and Animal Production Practices,
3. Innovations and Advanced Technologies
4. Macro and Micro Economic,
5. Social and Political milieus

4 Advanced Technologies

Traditionally the Smallholders often can't easily access new and advanced technologies such as Genetically Modified Seeds (GMS) and Nanotechnology. These technologies prove to increase productivities, control losses and manage risk. GMS first and second generations produced drought & disease resistant seeds, high yields varieties that can be mechanically be harvested and meet consumer expectation.

On the other hand, Nanotechnology applications are gaining momentum in all aspects of food production system. Both GMS and Nanotechnology research are considered private properties and remained in the multinational corporations and private research institution domain.

5 ICT and Sustainable Agriculture

ICT is an Umbrella term that Includes: Anything ranging from Radio to Satellite Imagery to mobile phone or Electric money Transfer

ICT no longer is considered luxury for Developing Countries (DC.) In fact, many of the ICT innovations are emerging from DC. They are creating new ways of communicating, doing business and delivering services. Through extending access to ICTs

A linear approach can exclude other stakeholders in the agricultural sector such as universities, agribusiness, traders, and nongovernmental and civil society organizations. It does not reflect the many well-documented ways that agricultural innovation actually occurs, such as experimentation by individual farmers, informal networking among farm communities, private sector participation, collaboration among extension workers interested in a particular idea, collaboration between researchers and farmers, and the adaptation by all of these actors of knowledge and practices from domains outside agriculture.

6 Key that Drive ICT in Agriculture

ICT in agriculture, particularly for poor producers:
Ø low-cost & Pervasive Connectivity
Ø Adaptable and more affordable tools
Ø Advances in data storage and exchange,
Ø Innovative business models and partnerships, and
Ø The democratization of information, including the open access movement and social media. These drivers are expected to continue

7 ICT and Agriculture

ICTs appear ideally suited to the task of enhanced interaction because they can expand communication, cooperation, and ultimately innovation among the growing array of actors in agriculture. ICTs, especially mobile phones, can and do drive participatory communication, including communication from those on the margins of traditional research-extension processes, and they are often the key instruments that organizations use to deliver services to larger numbers of rural people than they could reach before. ICTs are fundamental to the Sustainable Agriculture, smallholders and "farmers," public and private—extension agents, consultants, companies contracting farmers, and others—emerging to stakeholders device, knowledge, collaboration, and interaction among groups and communities throughout the agricultural sector.

Numerous electronic tools increase interaction among the actors involved in agriculture. On a macro level, e-Science (e-Research) draws on increasingly connected and extensive digital infrastructure to facilitate collaboration and knowledge exchange nationally, regionally, and globally. On a micro level, m-Agriculture, powered by increasingly affordable mobile digital devices such as phones, laptops, and sensors, how much processor, bandwidth, and storage capacity are needed? The required resource is made available immediately

8 Cloud Computing-- (CC :)

For the Smallholders cloud computing is a form of outsourced IT services. Enabled smallholders and farmers to store their information and data with little upfront costs, does not require purchase or maintenance of significant hardware and scale down to the need of the farmers or smallholders without purchasing new software or hire new personnel.

The advantage of cloud computing is that it offers pooled and elastic resources on demand over the Internet (Porcari 2009) National Institute of Standards and Technology (NIST.) More specifically, cloud computing has been described as "a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" (Mell and Grance 2009 NIST)

Over the years Cloud Computing eased the data collection and aggregation process, which is critical for research, extension, and education. Smallholders often lack access to timely, cost-effective, and personally relevant information on improved practices, markets, prices, inputs, weather and impending disasters, Smallholder farmers, who still provide a significant portion of the world's food, need to level the plain and access information, technology, innovation and market channels to advance their production to feed the world.

The need to Access essential information on prices, markets, varieties, production techniques, services, storage, or processing underscores growth in Food production. ICT is changing the above scenario as the types of ICT-enabled services useful to improving the capacity and livelihoods of poor smallholders are growing quickly.

9 Mobile Phone

v Around three-quarters of the world's inhabitants now have access to a mobile phone and the mobile communications story is moving to a new level, which is much about the phone but how it is used.

v The number of mobile subscriptions in use worldwide, both pre-paid and post-paid, has grown from fewer than 1 billion in 2000 to over 6 billion now, of which nearly 5 billion in developing countries.

v The mobile phone has evolved from a simple voice device to a multimedia communications tool capable of downloading and uploading text, data, audio, and video—from text messages to social network updates to breaking news, the latest hit song, or the latest viral video

v A mobile handset can be used as a wallet, a compass, or a television, as well as an alarm clock, calculator, address book, newspaper, and camera. Mobiles are also contributing to social, economic, and political transformation. Farmers in Africa obtain

pricing information via text messages, saving time and travel and making them better informed about where to sell their products, thereby raising their incomes (World Bank 2011a, 353).

The Mobile phone impacts on stallholders and farmers in four major areas:

· Improving access to financial services,
· Providing Agricultural information
· Cultivating data conspicuousness for supply chain adeptness, and
· Promoting access to Market

Short Messaging Service (SMS)

v SMS is now enabling mobile phones to be used as a platform for agricultural information exchange.
v SMS enable the smallholders to exchange technology advancement
v SMS will enable the smallholders to access innovation
v SMS enable smallholders to enhance the implication, adaptation & adoption of Technologies advancement.
v SMS enable the smallholders to communicate their best practices

10 Mobile Phone Opportunities and Constraints

v Mobile phone can link farmers and smallholders to finance, education, nutrition & health, prices and market channel
v Monitors resource, track processing, control quality and production
v Collect data on biodiversity
v Access research and advanced technology from available public information centers:

Such as FAO, UNIDO UNDP, the World Bank, the Coherence in Information for Agricultural Research for Development (CIARD) Formally, Consultative Group on International Agricultural Research (CGIAR) that funded the 15 International Agricultural Research Centers

12 Conclusions

In conclusion Sustainable Agriculture and ICT are integral part of food production chain. Both are multidisciplinary & convoluted sectors. Therefore demand collective support and coordination of all main actors, policy makers and decision makers in Food Production. ICT networking provide upstream/downstream movement as well as backward/forward collaboration and cooperation,

The Author underscored critical achievement factors include the development of local stewardship and understanding, testing solutions and methodological regulatory participation. These fundamental elements can ensure that the content and methods of delivery are designed to both market and crop type. Therefore, not only the smallholder and farmers benefit from increased incomes and revenues, but also all main actors in both ICT and Sustainable Agriculture benefit through systematic data collection and information.

The domino effects of social and economic revenues that these prospective could deliver are well beyond the food production chain.

Session 4: Urban Green & Agroforestry

Measurements and Simulation of Microclimatic Effects of a Horizontal Hydroponic Pergola

Constantinos Kittas[1], Dimitrios Antoniadis[2], Nikolaos Katsoulas[2], Ioannis L. Tsirogiannis[3], Gregorios Varras[3] and Thomas Bartzanas[4]

[1]University of Thessaly, Department of Agriculture Crop Production and Rural Environment, Fytokou Str., 38446, Volos, Greece, e-mail: ckittas@uth.gr
[2]University of Thessaly, Department of Agriculture Crop Production and Rural Environment, Fytokou Str., 38446, Volos, Greece
[3]TEI of Epirus, Dept. of Agricultural Technology, Unit of Floriculture and Landscape Architecture, 47100 Kostakii Arta, Greece
[4]Centre for Research and Technology Hellas, Institute for Research and Technology of Thessaly, Dimitriados 95, 38333, Volos, Greece

Abstract. The microclimate model ENVI-met (V4) was used for predicting the effects of different systems of planted pergolas on the microclimate of an atrium. The model was firstly validated using experimental data and then used for different cases studies. The microclimate measurements were carried in a real construction project of a hydroponic pergola at Kostakii Campus of the Technological Education Institute of Epirus (Arta, Greece). The validation results showed a very good agreement between measured and simulated values of air temperature. The model was used to predict the effects on air temperature (T_{air}), relative humidity (RH), mean radiant temperature (T_{mrt}) and Physiologically Equivalent Temperature (PET) when of 0%, 50% and 100% of the atrium horizontal plane area was covered by the planted pergola. The results showed that compared to the case with no pergola in the atrium, covering 100% the atrium area with a planted pergola reduced average Tair up to 0.78 and 1.3 ºC during the day and night, respectively, while at the hottest time of day, T_{mrt} was lowered 29.4 ºC and the PET was lowered up to 17.9 ºC.

Keywords: ENVI-met V4.0, CFD, Thermal comfort, PET

1 Introduction

The amelioration of living conditions in urban environments has been set as a high priority goal in both national and E.U. level. The bioclimatic design of buildings and urban hardscapes constitutes a promising option which has the dynamic to contribute extensively to the diminution of the serious environmental problems that harass urban areas. The installation of green surfaces on buildings is one of the most valuable tools of this approach, as because of the physiological functions of the plants (photosynthesis, respiration, evapotranspiration) and the physical characteristics of the planting system, produce favorite changes to both the internal (Monteith and Unsowrth, 2008; Alexandri and Jones, 2008) and surrounding

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environment of buildings (Hoffman και McDonough, 2004; Takebayashi and Moriyama, 2007; Fang 2008; Robbert et al., 2009).

The use of pergolas has great history as structural element in Mediterranean architecture. Montero and Salas (2009) studied a hydroponic pergola and outlined its positive effects in microclimate. The hydroponic pergola and the hydroponic vertical frame (which are the main points of interest of the proposed project) have the advantage –when compared to the conventional shading structures- that they give the landscape architect a field for design creativity as the a number of different plants could be synthesized in order to create the final result.

Experimental data and development of know-how in local level (thus considering local climatic conditions) are in luck -and for that indispensable- for the case green structures on buildings. In this framework the selection of plants is of great interest (Filippi, 2008, Salas and Montero, 2009; Benvenuti, 2009). Also the study of real scale green structures, their design, working parameters and effects on microclimate constitute an innovative research filed. Solutions regarding design, substrate, nutrient solution and management are expected to be valuable for the spreading of such systems.

Finally the numerical modeling of such systems will allow the study of numerous different scenarios regarding their design. Yang et al. (2013), after a brief presentation of studies that attempt to assess the performance of ENVI-met software by comparing simulation results with field data, conclude that the ENVI-met model is capable of modeling outdoor thermal environment for different climate patterns with acceptable accuracy.

The objective of the present study is to validate the results simulated by the recent version (V4.0) of ENVI-met software and then use it for the evaluation of different design of such structures.

2 Materials and Methods

2.1 Experimental facilities

The measurements were made at the Kostakii Campus of the Technological Education Institute of Epirus (TEIEP, latitude 39º 07′N, longitude 20º 56′E, altitude 5m), near Arta, at the north-west coastal area of Greece. According to HNMS (2014), the climate of the area is classified to Mediterranean type, with hot summers and mild but rainy winters.

A hydroponic pergola (WxLxH in m: 7x8x2.3) was constructed in order to host a horizontal planting system. The pergola was placed in the open air central atrium (WxLxH in m: 15x20x7) of Floriculture & Landscape Architecture (FLA) building of TEIEP. This selection was based on the assumption that the atrium resembled a densely structured urban area. Plastic tubes (PVC, Ø125) were used as substrate containers. Each container was 1 m in length, with screw cap endings, 3 evenly spaced holes (0.05 m) for planting at the top and drainage holes (3 rows of 10 holes each) at the bottom. The containers were placed on gutters (PVC, Ø125). The gutters

were spaced 0.6 m apart following a horizontal lay-out on the pergola and 0.4 m apart following a vertical lay-out on the vertical hydroponic wall. The containers were filled with perlite (1-5 mm). A closed-loop system was used for the nutrient solution supply. The pergola hosted 144 plants in 8 planting rows and included the following plants: *Dimorphoteca sinuata*, *Gazania rigens*, *Lavandula angustifolia*, *Pelargonium peltatum*, *Pelargonium zonale*, *Petunia surfinia*, *Rosmarinus officinalis* "Prostratus", *Santolina chamaecyparissus* and *Pelargonium capitatum*.

A number of parameters were continuously monitored: a) air temperature (T_{air}, ºC) and relative humidity (RH_{air}, %) by means of three temperature and humidity sensors (HD9008TR; DeltaOhm, Padua, Italy): one bellow (at a height of 1.75 m) and two sensors above the plane of the pergola (height 3 and 5 m, respectively) and b) solar radiation below the pergola (at a height of 2 m, Rs in W m^{-2}) by means of a solar pyranometer (SKS 1110; Skye Instruments, Powys, UK). Measurements took place every 30 s and the 10-min average values were recorded.

The microclimate (air temperature and relative humidity, solar radiation, wind speed and direction) data outside the atrium were also measured and recorded in a nearby meteorological station located in an open area of the Campus.

Days from the period without or with the pergola in the atrium with very similar meteorological data in the reference weather station were selected, and the meteorological data collected in the centre of the atrium with and without pergola, were compared, so that to investigate the influence of pergola in the microclimate of the atrium.

The evaluation was carried out during 2009 and 2010 with the atrium empty and during 2013 and 2014 with the hydroponic pergola installed in the atrium.

2.2 Simulations

The current version of ENVI-met model (4.0) was used to simulate the microclimate of the experimental site. This three-dimensional microclimate model is based on computational fluid dynamics (CFD) and thermodynamics, is able to simulate flow around and between buildings, exchange processes of heat and vapor at the ground surface and at walls, exchange of energy and mass between vegetation and its surroundings, bioclimatology, and particle dispersion (Yang et al. 2013). The spatial resolution of the model reaches 0.5 m and the time step can be between 1 and 5 s.

The actual environment and elements of the site, such as building, vegetation, soil, etc., were defined in an ENVI-met area input model (Fig. 1). The plastic tubes (PVC, Ø125) used as substrate containers, were created in Detailed Design Model Type as façade elements with top of façade in 3 m and bottom at 2 m and were set in editing mode as whole façade with individual segment material as PVC Sun Sail (thickness of layer 0.02) with default characteristics from the ENVI-met Material Database. In horizontal direction, the main model area (30 x 35 m) was constructed with 60 x-Grids and 70 y-Grids, with grid size dx, dy of 0.5 m. Around the main area 3 nesting grids were set with nesting grid soil Profile "Default Unsealed Soil". In vertical direction, 30 z-Grids were used with Grid size of 0.5m. The vertical grid generation was equidistant for the first 8 m with equal dz height and with a telescoping factor of

20% after the height of 8 m. Geographic Properties of the model were set for grid north and location on earth as for the location of the experimental site. The height of the plants was uniform and set to 0.5 m with a leaf area density (LAD) value of 1, resembling the median LAI factor of the used plants and the full coverage of the pergola with plants after the beginning of August. The hourly meteorological data from the on-site open area meteorological station were used to generate the forcing file for the simulation. Weather conditions for those days were typical for a hot humid day of August, in Arta.

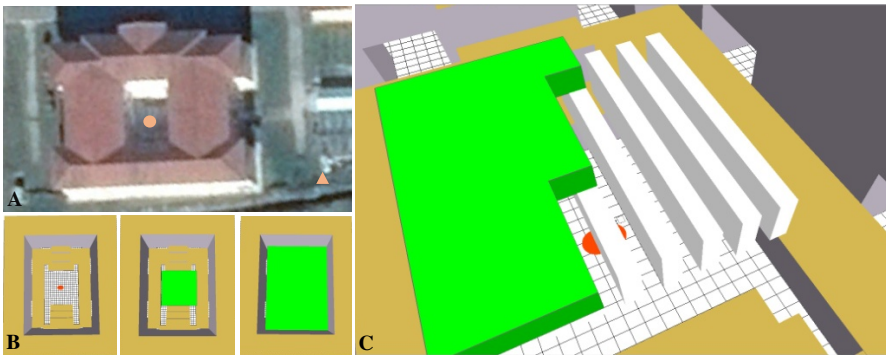

Fig. 1. 3D area input model for ENVI-met simulation. A. Satellite image of Kostakii Campus. With ● marked the place of the Atrium where meteorological parameters were continuously monitored. With ▲ marked the reference Weather Station B. Simulation of 0%, 50% and 100% area of Atrium covered by planted pergola. C. Detail of the construction of ENVI-met model.

The model was used to predict the effects of 0%, 50% and 100% area of atrium covered by the planted pergola of LAD 2 and the effect of a 50% atrium covered area with LAD 2 or 5, on air temperature, relative humidity, mean radiant temperature (T_{mrt}) and Physiologically Equivalent Temperature (PET). For the simulation of the three case studies, the same hourly meteorological data from the reference weather station were used to generate the forcing file. The simulations ran for 24 h, starting at 00:00 and ending at 23:59 of the same day. The case of 0% resemble to thermal conditions that prevail in empty atrium, the case of 50% resemble to the real construction project of the hydroponic pergola in the present study and 100% area of atrium covered by the planted pergola resemble to thermal conditions if the whole area of the atrium was covered by the planted pergola.

3 Results and Discussion

3.1 Model validation

The comparison between measured and simulated values of air temperature observed at the height of 1.75 m for the cases with and without the planted pergola in

the atrium is presented in Fig. 2. It can be seen that a very good agreement was found between the measured and simulated values of air temperature. The regression lines between measured and simulated values of air temperature for the two cases found were:

- Empty atrium: Simulated = 0.98 Measured,
- Atrium with pergola: Simulated = 0.99 Measured,

with a determination coefficient R^2 of 0.98 and 0.93, respectively.

The largest difference between the simulated and the measured air temperature observed in the atrium was 1.1 ºC for the case without pergola in the atrium and 1.3 ºC for the case with pergola in the atrium and were observed during periods with rapid change of climate variables.

The average daytime value of simulated air temperature in the atrium for the case without and with pergola during the 3 days period were 29.2 ºC and 28.9 ºC while the corresponding measured values were 29.7 ºC and 29.2 ºC.

Taking into account the above results, it could be concluded that the model fitted with the simulation model was suitable for the present purpose.

It has to be noted that the 6 days selected for comparison with the simulated data had similar climate conditions in the reference meteorological station. Thus any differences observed in the microclimate conditions measured in the area of atrium between the two cases are due to the presence of the planted pergola in the atrium.

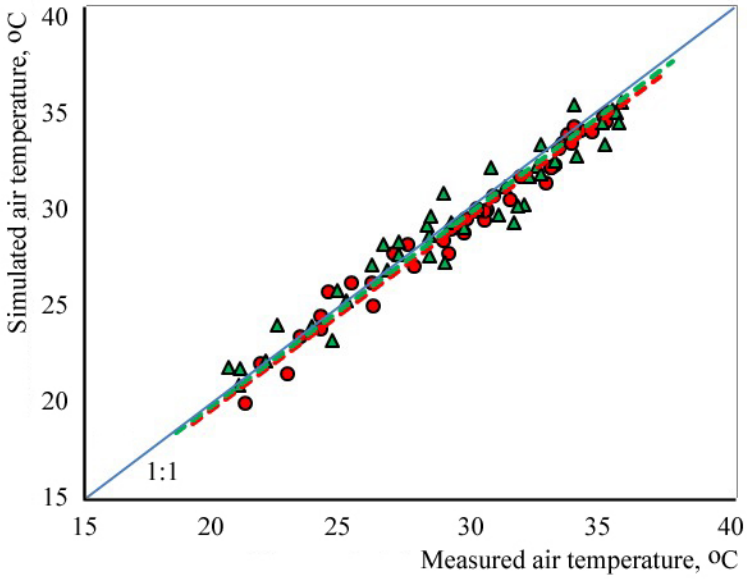

Fig. 2. Simulated vs measured values of air temperature during three different days for the case with or without the pergola in the atrium. Circles: atrium without the pergola; triangles: atrium with pergola. The continue line represents the 1:1 line while the dotted lines represent the regression lines of the data.

Based on the differences observed in the measured values of air temperature, it could be seen that the planted pergola resulted in a reduction of air temperature in the atrium during daytime of about 0.5 ºC. A similar reduction was also observed when examining the simulated values of air temperature. The relatively low effect of pergola on the air temperature observed in the atrium could be attributed to the relatively low leaf area of the plants grown in the pergola, the fact that the plants used were mainly aromatic herbs, which have low transpiration rate; and the relatively small area of the pergola in comparison to the total atrium area. However, the planted pergola has a significant effect in the reduction of solar radiation below the pergola and accordingly to the thermal indexes related solar radiation and radiation temperature.

3.2 Scenarios analysis

Different scenarios studies were tested to study the effect of a planted pergola on the microclimate observed in the atrium and the daytime and nighttime average values of the microclimate parameters. The radiation fluxes (i.e. short wave and long wave) absorbed by a human body and their effect on its energy balance are taken into account through the mean radiant temperature (T_{mrt}) (Gulyás et al. 2006), which is taken into account by the majority of the indices used to describe thermal comfort (Hassaan and Mahmoud 2011). Furthermore, the thermal comfort conditions were assessed by means of the Physiologically Equivalent Temperature (PET). The Thermal Index PET (ºC) was calculated using RayMAN pro model, Version 2.1. As input data was used T_{air}, RH_{air} and T_{mrt} simulated at a height of 1.25 m at the center of the pergola and clothing factor clo=0.5 that corresponds to a standing man wearing a trousers and a short-sleeve shirt. All other parameters were the default of the model. The results are shown in Table 1.

Table 1. Simulated values of microclimate parameters and calculated Thermal Index PET at a height of 1.25 m at the center of the atrium.

Case study	T_{air}		RH_{air}		T_{mrt}		PET	
	Day	Night	Day	Night	Day	Night	Day	Night
Empty atrium	29.33	21.94	55.41	85.40	38.58	11.29	35.33	17.32
Planted atrium, 50% area of atrium covered by pergola, LAD 2	28.85	20.50	57.29	92.76	31.41	11.06	30.75	16.48
Planted atrium, 50% area of atrium covered by pergola, LAD 5	28.75	20.75	57.86	90.80	31.02	11.54	30.50	16.81
Planted atrium, 100% area of atrium covered by pergola, LAD 2	28.55	20.64	58.43	91.40	29.36	11.43	29.55	16.70

It can be seen that a fully covered atrium with a planted pergola of LAD 2 resulted in about 0.8 ºC lower air temperature during daytime and about 1.3 ºC during nighttime. However, the significant effect of the planted pergola can be seen in the T_{mrt} and PET values observed. When a planted pergola was simulated in the atrium the T_{mrt} and PET values observed were much lower than those observed in the empty atrium. The PET value observed at during the hottest part of the day in the center of the atrium at a height of 1.25 m was 52 ºC when the atrium was empty and 36 ºC and 34 ºC when 50% or 100% of the atrium area was covered by a planted pergola, respectively.

4 Concluding Remarks

The ENVI-met simulation program was validated using experimental data and then used for different cases studies. Validation revealed that the air temperature values could be efficiently simulated by the program. The case studies presented showed that compared to the case with no pergola in the atrium, covering 100% the atrium area with a planted pergola reduced average Tair up to 0.78ºC and 1.3ºC during the day and night, respectively, while at the hottest time of day, Tmrt and the PET were 29.4ºC and 17.9ºC lower.

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A Web-based DSS for Sustainability in Urban Green Zones

Grigorios Varras[1], Zacharoula Andreopoulou[2], Christiana Koliouska[3], Evangelos Tasoulas[4], Christos Myriounis[5]

[1]Department of Agricultural Technology, Unit Floriculture & Landscape Architecture, Technological Educational Institution of Epirus, tel. 2681050235, Greece
e-mail: grvarass@teiep.gr
[2]Laboratory of Forest Informatics, School of Forestry and Natural Environment, Aristotle University of Thessaloniki, Box 247, 54124, tel. 2310992714, Greece,
e-mail: randreop@for.auth.gr
[3]Laboratory of Forest Informatics, School of Forestry and Natural Environment, Aristotle University of Thessaloniki, Box 247, 54124, tel. 2310992722, Greece,
e-mail: ckolious@for.auth.gr
[4]Department of Agricultural Technology, Unit Floriculture & Landscape Architecture, Technological Educational Institution of Epirus, Greece
e-mail: tasoulasv@gmail.com
[5]Department of Agricultural Technology, Unit Floriculture & Landscape Architecture, Technological Educational Institution of Epirus, tel. 2681050235, Greece
e-mail: cmiriounis@yahoo.com

Abstract. The utilization of urban green zones forms a major part of urban sustainability in the context of the improvement of quality of life of the citizens. Within the policy for sustainable management of urban green zones, the tools that are used effectively are new technologies such as web databases, web DSS, GIS and environmental impact prediction model. This paper presents the geodatabase, which was used as a background for the GIS and the ENVI-MET application in order to develop city microclimatic maps. Microclimatic maps will constitute a very important tool for the decision-making process in urban forest policy. The results will be presented as a spatial imaging system, through a software development for the GIS platform where the effects will be illustrated. The integrated web platform for the management of urban green zones constitutes an important step for the maintenance and improvement of quality of life in urban areas, the environmental sustainability, the environmental information dissemination, the improvement of urban planning and the web-DSS utilization for the integrated management of urban green zones.

Keywords: web-based DSS, sustainability, urban green zones, microclimatic maps, geodatabase.

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1 Introduction

The utilization of urban green zones forms a major part of urban sustainability in the context of the improvement of quality of life of the citizens. Besides a greater tax base, preserving green zones, forests, river corridors, maintains the necessary biodiversity that enables this planet to function, creating oxygen, filtering carbon dioxide and other natural effluents; these processes are not only beneficial for quality of life they are critical for life itself (Kantartzis et al. 2007). Within the policy for sustainable management of urban green zones, the tools that are used effectively are new technologies such as web databases, GIS and environmental impact prediction model. Tasoulas and Andreopoulou (2012) indicate that Information and Communication Technology (ICT) is a discipline that can be adequately exploited in many scientific fields, aiming to help local authorities/administrative in decision-making process. This diffusion has already intruded in urban forestry management and administrators exploit software in order to make their management plans more virtual (Tasoulas et al 2013).

A database is a tool that local authorities/administrative can use to plan and standardize their practices for sustainability in urban green zones. Database is an essential Decision Support (DSS) tool while the web-based application simplifies the sustainable management of urban forest even more. A web-based DSS is a computerized system that delivers decision support information or decision support tools to a manager using a "thin-client" web browser (Engel et al. 2003). Due to the growing interest in the Web, there are many on-going efforts to develop and implement Web-based DSS in various areas (Bhargava et al. 2007), such as urban forest protection.

1.1 Background of the research

The present paper is part of the research program «URBAN: Integrated Framework of Management, Protection and Utilization of Urban and peri-Urban Forest» that deals with the study and recording of urban green zones. It is therefore an integrated research of the selected urban hedgerows in the four major Municipalities of Epirus Region during which the mapping of environmental impact is achieved combining the results of the contemporary research in the field of Urban Foresting, with the latest developments in the field of new ICTs.

The project aims to develop innovative quantitative and qualitative methods through the development of an innovative model to quantify the impact of "urban heat island" on the microclimate of the town considering the terrain type, the existence and the area of surface water, the kind, the exact location and the surface area of the island, the plant species and their special characteristics.

The tasks that will have been completed during the project implementation are the following: Studies on the field of natural environment, prediction microclimatic effects model, analysis of the Integrated Geoinformation System requirements, Integrated Geographic Information System development, data collection in the field

and insertion in the database, awareness website development, public dissemination of research results.

This paper presents the geodatabase, which was used as a background for the GIS and the ENVI-MET application in order to develop city microclimatic maps. Microclimatic maps will constitute a very important tool for the decision-making process in urban forest policy. The results will be presented as a spatial imaging system, through a software development for the GIS platform where the effects will be illustrated.

2 Paper Preparation

The database contents include geographical entities, vectors and descriptive information concerning the integrated recording information about the urban green zones of selected islands (the so called ENVI islands) in 4 cities of Epirus region, Arta, Ioannina, Preveza and Igoumenitsa. Functional and technical requirements analysis was carried out in order to constitute part of the digitized Geodatabase platform. The information recorded is about the area, the existence of surface water, the type, the exact location of the islands, the plant species and their special characteristics, such as: botanical and common name, tree height, height were canopy begins, canopy height, canopy diameter, diameter breast height, perimeter breast height, tree health, tree stability. The information recorded about the tree damages are the following: limited growth space, sidewalk elevation, stump decay, trunk twist, splits on tree trunks, vandalism, damages caused by pruning, drying, broken branches, asymmetric canopies, tassels caused by pruning, insects, yeasts, liquid outflow, ivy-pests. The manipulations for the restoration of the damaged trees ban be: removal, monitoring, scheduled tree pruning, manipulations for tree injuries, none. The data of polygons that will be collected in public areas, will concern the shrubs, the herbaceous plants, the surfaces covered with water stones etc, the trees that cannot be mapped individually.

In addition, the orthophotomaps of National Cadastre and Mapping Agency and of Google were used as a background for the digitization tasks of urban green zones through photo-interpretation. Aiming at the dissemination of the environmental information, the optimization of urban planning with regard to sustainability and the database utilization for integrated management of urban forest, the database is available on the web within the Integrated Geo-Information Platform System through the research program URBAN (http://urbantreemanagement.teiep.gr). The platform allows the database utilization for the city microclimatic map development for the quantification of green zones effects on the city microclimate aiming to take the appropriate measures within a rational policy for the management of urban green infrastructure in the interests of quality of life of urban network and population.

In Figure 1, the main interface of the Scenario Map is presented. In this step, the user has to select which one of the four municipalities is interested in.

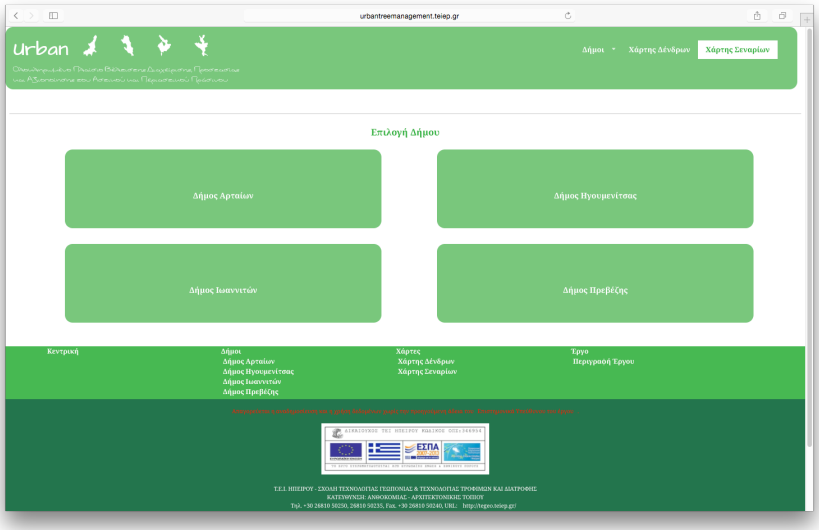

Fig. 1. The main interface of the Scenario Map

Then, the user selects the scenario and the index that will be illustrated by the microclimatic map. There are two possible scenarios: a typical summer day and a typical hot day. The provided indexes are the following:

- Discomfort Index (DI): expresses the human discomfort because of the air temperature and humidity
- Predicted Mean Vote (PMV): expresses the mean response of a larger group of people according to the human thermal comfort sensation
- Predicted Percentage Dissatisfied (PPD): expresses the predicted percentage (%) of people who are thermally dissatisfied in a place
- Sky View Factor (SVF): expresses the solid angle of sky view from land surface
- Air Temperature (T2m): expresses the air temperature (oC) at 2m height above the ground
- Surface Temperature (Ts): expresses the surface temperature (oC)

In Figure 2, the microclimatic map regarding the air temperature of a typical summer day in Preveza city. By locating the mouse cursor on a point of the microclimatic map, further information about the selected index value is presented.

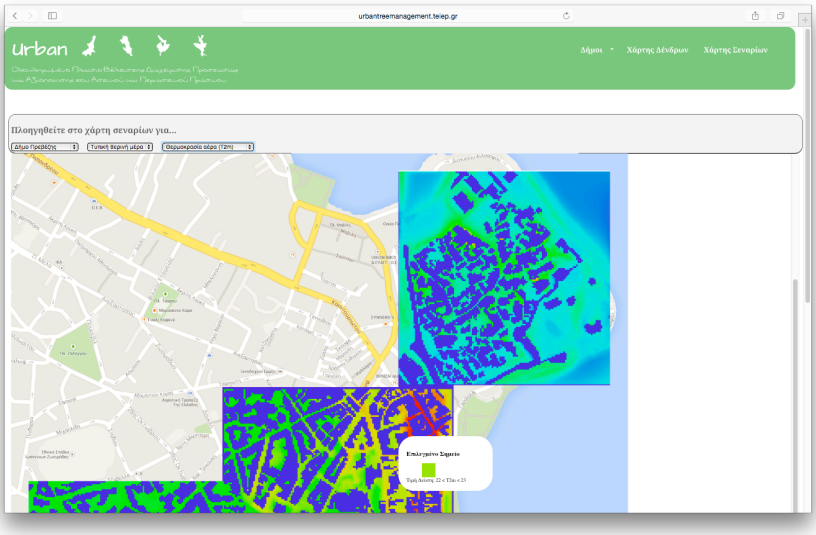

Fig. 2. Microclimatic map regarding the air temperature of a typical summer day in Preveza city

In Figure 3, the microclimatic map regarding the discomfort index of a typical hot day in Ioannina city.

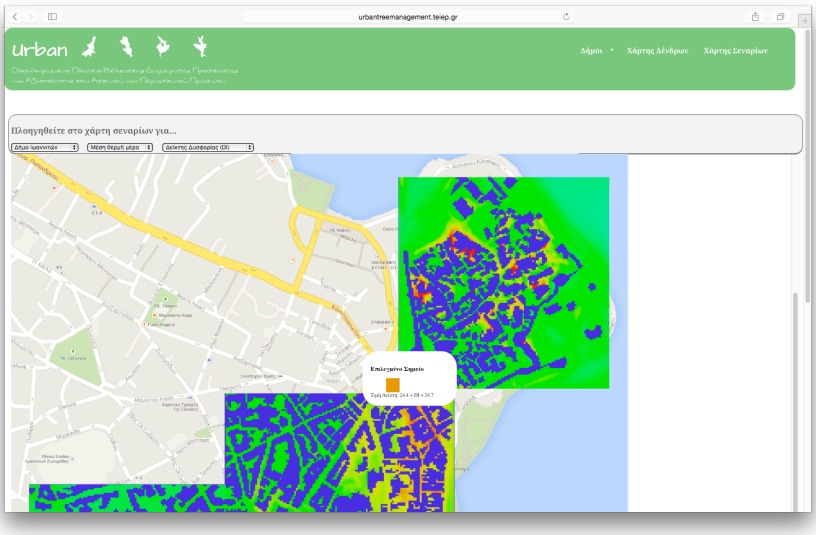

Fig. 3. Microclimatic map regarding the discomfort index of a typical hot day in Ioannina city

The integrated web platform for the management of urban green zones constitutes an important step for the maintenance and improvement of quality of life in urban areas, the environmental information dissemination, the improvement of urban planning and the web-DSS utilization for the integrated management of urban green zones. The web-DSS gives prominence to the "Sustainable Development" of urban areas as the fundamental principle for the citizens.

The purposes of the research proposal are summarized in the following axes:

1. Expansion of the experience of the involved research teams in the scientific field related to the optimum control of shade, temperature, the minimization of the "urban heat island" effect and
2. Sustainable development enhancement through the design and implementation of policies by leading citizens and organizations to the optimal use of urban resources (water supplies, optimizing the characteristics of urban and peri-urban green zones, etc).

The web-DSS interface is developed in the Greek language because it constitutes part of a research program of TEI of Epirus called "URBAN: Integrated Framework of Management, Protection and Utilization of Urban and peri-Urban Forest". A future extend of the web-DSS could be the creation of multiple versions of the interface in other languages aiming to form a useful tool for managers abroad. However, adjustments should have to be made in the original code of the DSS whenever it is required, because every type of forest ecosystem is characterized by different needs.

Acknowledgments. This paper was accomplished within a research program of TEI of Epirus called URBAN: Integrated Framework of Management, Protection and Utilization of Urban and peri-Urban Forest. This research has been co-financed by the European Union (European Social Fund – ESF) and Greek national funds through the Regional Operational Program (ROP) of Epirus of the National Strategic Reference Framework (NSRF) - Research Funding Program NEA GNOSI.

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Building a European Agro-Forestry Training and Learning System Model in the AgroFE Leonardo Project - Hungarian Specialities

László Várallyai[1], Miklós Herdon[2], Charles Burriel[3], János Tamás[4], János Pancsira[5]

[1]University of Debrecen, Faculty of Economics, Hungary,
e-mail: varallyai.laszlo@econ.unideb.hu
[2]University of Debrecen, Faculty of Economics, Hungary,
e-mail: herdon.miklos@econ.unideb.hu
[3]Agrosup Dijon, France, e-mail: charles.burriel@educagri.fr
[4]University of Debrecen, Faculty of Agricultural and Food Sciences and Environmental Management, Hungary, e-mail: tamas@agr.unideb.hu
[5]University of Debrecen, Faculty of Economics, Hungary,
e-mail: pancsira.janos@econ.unideb.hu

Abstract. The aim of the AgroFE project is to play an important role in Agro-forestry trainings in European dimension. Depending on the European countries, states or professional organizations and training actors try to reintroduce agroforestry training and education in different levels. The main objectives are to make a synthesis of needs and expectations, based on the present existing training actions and to set up a common framework, to build an innovative training system, to create a technical collaborative support for implementation of the project with ICT tools and providing access to the resources and training services during and after the project (knowledge databank, interactive services). The system architecture is based on open source concept for handling many formats in the knowledge databank. Regarding to the different trends in e-learning business models we dealt with different technological solutions. We created the collaborative platform which consist of a learning management system, videoconference services, video-repositories. The prototype of knowledge databank has been developed. The paper presents the results and the planned services.

Keywords: Agroforestry, e-Learning, education, training, knowledge databank

1 Introduction

The AgroFE project is aimed at actors in agroforestry. The agricultural system has experienced a strong abandonment of agroforestry (Nair, 2005) in the 20th century, to count today only a few million ha in Europe (Price, 1995). Depending on the countries, states or professional organizations and training actors (Jamnadass et al., 2014) try to reintroduce agroforestry in the course of training and qualification in

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initial training and in adult education. Based on the results of scientific research, development structures and those of the "farmer-researchers", experimental courses were conducted in different countries, including BE, FR, in the UK on a small scale as resources, trainers and available skills are scarce. In the partnership countries, the need for conversion and development is between 15,000 and 20,000 farms in the next 5-7 years (Gregorio et al., 2015), which means training so many operations managers on L4, L5 and L6 level by country. The partners have identified training needs in the short term. These needs are on the one hand operators and future operators, adults and pupils/students, teachers and counselors, tutors (Mbow et al., 2014). These requirements therefore relate to two levels of qualification L4 and L5/L6 and two types of learners: students and adults, farmers and future farmers on the one hand (mainly L4/L5) and advisors, level L5/L6. In the short term, the project will address these two public through a system established by the partners (Herdon at al., 2011; Várallyai and Herdon, 2013): based on innovative teaching practices training, occupational situations providing access to recognized qualifications (NQF, EQF, ECVET and ECTS). Fortunately the ICT tools have been developed increasingly nowadays, so there are tools and methods for e-learning and e-collaboration (Bustos et al., 2007; Herdon and Lengyel, 2013; Herdon and Rózsa, 2012. One of the important parts of the project is to apply innovative solutions (Gamboa et al., 2010) for building and using the web site (http://www.agrofe.eu/) and knowledge repositories for teaching and learning agroforestry (Beddie and Halliday-Wynes, 2010).

The term e-learning is widely understood to refer to the use of information and communications technology (ICT) in learning and teaching. E-learning systems can be observed at both the institutional and the local level in higher education. Institutional systems include learning management systems (LMS), used primarily to manage delivery of course material to enrolled students, and the platforms that support massive online open courses (MOOCs - Porter, 2015). Local e-learning systems are observed at the level of a single course, class, lesson or learning activity. While investments at both levels can contribute to improvements in learning and teaching (Gunn, 2010), each has its own goals, methods and challenges.

2 Collaborative Work

A variety of ways that two or more organisations can work together is covered the collaborative working. The range is wide from informal networks and alliances, through joint delivery of projects to full merger. Collaborative working can last for a fixed length of time or can form a permanent arrangement. What these options have in common is that they involve some sort of exchange, for mutual advantage, that ultimately benefits end users. In recent years, interest in collaborative working has been growing, driven by the sector's drive for effectiveness and efficiency, government policy and public opinion.

CWE (Collaborative Working Environment) can be perceived as the tools, technologies, services and environments supporting individual persons in their working tasks to become more creative, innovative and productive involving the

direct or indirect interaction (collaboration) with other individuals, groups or organizations. Collaborative platforms providing sophisticated upper middleware services required for environment and person-aware distributed collaboration. It is based on system integration of Web Services, Semantic Web. They can provide the support and operations required for complex virtualised working environments. Works include development of tools for sharing resources, knowledge/resources discovery, service composition, CSCW tools (including multi-conferencing) to ensure stable, dependable collaborative applications.

We need to support is the virtual meeting. In Hungary there is a High speed research and education networks which enable an uncompromised quality audio and video collaboration. This system offers the following collaboration services (http://www.niif.hu/en/):

- Video and desktop conference (IP based videoconference). From anywhere to anywhere, with any number of participants for project and administrative meetings, consultation, distant teaching and learning.
- Videotorium: Video sharing portal for higher education, research and public collections. Share research and education recordings through Videotorium, in up to high definition (HD) quality.

The video network now features around 140 meeting room terminals spread all over the country, and a compatible desktop videoconference system is available to be used with a computer and web camera. Within the AgroFE project we use the Multipoint Control Unit which gives HD services, it is able to record and/or broadcast the meeting on the Internet. The Desktop system is also used because every partner can join in a virtual meeting room very simply and we connect this virtual room with every participant to the MCU server. This desktop system works with the Vidyo software.

2.1 Moodle

Online courses are moving into the mainstream and the software commonly used to deliver online courses can be prohibitively expensive. Classes take place online through the use of software packages that have special classroom features such as discussion forums calendars, chat rooms, where participants can communicate in real time with each other, and quiz and polling capabilities. Files such as word processing documents, sound files, pictures, and videos can be uploaded to the virtual classroom for viewing by students. Thus, the "platform" is essentially a place that looks like a private website and is intended to work like an electronic classroom. The classes taught on these platforms are accessible via the Internet, and are usually private, meaning that only individuals who are registered for the class can see the password-protected website. A platform for online courses may also be called an LMS (Learning Management System) or LCMS (Learning Content Management System).

Like many other higher education institutions, we introduced the Moodle system at University of Debrecen Centre for Agricultural and Applied Economic Sciences (UD CAAES) in 2007 (Burriel, 2007, Lengyel and Herdon, 2009). In the past we used the Moodle in more European project for collaborative work and adult trainings too. The preliminary experience entitled us to use this system for creating a

collaborative space and e-learning in the AgroFE project (https://moodle.agr.unideb.hu/agrofe/).

2.2 Vidyo

The Vidyo portfolio (http://www.vidyo.com/) includes everything we need to deploy: the HD video collaboration to everyone in an organization, from core infrastructure to solutions that video-enable any device or application. Vidyo works the way we do. It runs on the devices we're using from smart phones to tablets, desktops to video room systems, bringing HD-quality video and content to every participant. The VidyoDesktop™ app extends high-quality video conferencing to Windows, Mac and Linux computers, allowing users on these systems to participate at office, from home, or on the road. With support encoding at resolutions up to full HD and dual-screen multipoint video.

The VidyoMobile™ app brings high-quality video conferencing to popular Apple and Android tablets and smartphones. Host a person-to-person or multi-party video conference from your office, home, or in transit on both wireless broadband and WiFi connections. As a full-featured endpoint in your VidyoConferencing™ solution, VidyoMobile delivers transcode-free video conferencing for natural communication at the pace of conversation, without the broken pictures associated with traditional solutions.

2.2 Videotorium

Videotorium is a video/audio sharing portal created for the players of research and education. Videotorium provides professional presentation of video content recorded at higher-education organisations, research institutions and public collections. Videotorium has been launched in June 2010 by the maintainer of the Hungarian research and education computer network infrastructure National Information Infrastructure Development (NIIF) Institute. The portal is the successor of former "Video on Demand" repository aiming professional accommodation for the growing collection of recordings and content upload and sharing by institutions.

Videotorium is freely available for users of any NIIF member institutions, but any non-profit research and education activity can be supported. The content created by affected organisations can be infinitely various: scientific conferences, seminars, university lectures, trainings, scientific events, scientific experiments, research PR, documentary, interviews, etc.

Primarily, the portal offers its services to higher-education (students, lecturers), research and public collection community users, but the high number of public recordings offers a good opportunity for learning or self-entertainment.

3 The Objectives and Development Methods

The main objectives are to make a synthesis of needs and expectations, based on the present existing training actions and to set up a common framework; to build an innovative training system (contextualized, modularized trainings, use of ICT, professionals participation); to create a technical collaborative support for the implementation of the project with communication tools (information of partners and promotion) and for providing access to the resources and training services during and after the project (knowledge databank, interactive services). To achieve this objectives the following main activities have to be carried out:

- Exploitation of the tools and services.
- Building a collaborative working environment.
- Planning the architecture for development, teaching and training.
- Implementing the e-learning environment.
- Designing the multimedia tools to make accessible for learners, trainers.

That is why we will be able to build a collaborative working environment for the project partners and players who will join to this knowledge database and information service. We have to use the following methods (do the following activities):

- Using the experiences from former project and practice.
- Studying new technologies and methods.
- Developing Agroforestry in agri-environment BSc course
- Evaluating them.
- Selection.

4 Results

For the collaborative working in the project we plan to use existing open source and free services. One of the essential solutions was the latest version of the Moodle system. One selection criterion was based on that we have more than 7 years' experience in using this popular system which can give every function that we need for collaborative working during the project. The ICT system of the project will be based on a knowledge databank service and for mobility (field) work we will use tablets with Android, IoS, Windows platforms, using the central services and apps.

4.1 e-Learning trends in Europe

Of the $4.1 trillion spent on education and training, approximately 25% is in Europe, making it the 2nd largest market to North America. In the schools market, Europe boasts 27% more teachers than the US, with 4.6 million teachers as compared to 3.6 million in the US (IBIS Capital, 2013).

The European e-Learning market is a highly fragmented market comprising up to 3,000 predominantly small entrepreneurial companies. The fragmentation represents in part the early stage nature of the industry and the market difference within Europe.

Although the relative difference in the size of markets between the US and Europe is not significant yet there is a big difference in the volume of venture deals in e-Learning. Since 2007, 60% of global venture investments in e-Learning have been in the US. Europe only accounts for 6% over the same period.

The spend on academic education and learning outweighs the spend on corporate training by about 18x. There is also a regional split between northern and southern Europe where for example in the Nordics workers are 4x more likely to be receiving training than in southern Europe.

The level of activity within e-Learning M&A in Europe is currently limited, with very few deals over $20 million. The market remains in development. The increase in venture investment is expected to fuel expansion and in due course increase strategic activity.

The evidence of increased investment in Europe in the sector and anecdotal support that companies are experience an upsurge in activity points to a market on the turn. We expect the e-Learning market to be characterised over the next 3 years by a significant increase in investment in the sector as well as a level of consolidation as companies seek scale.

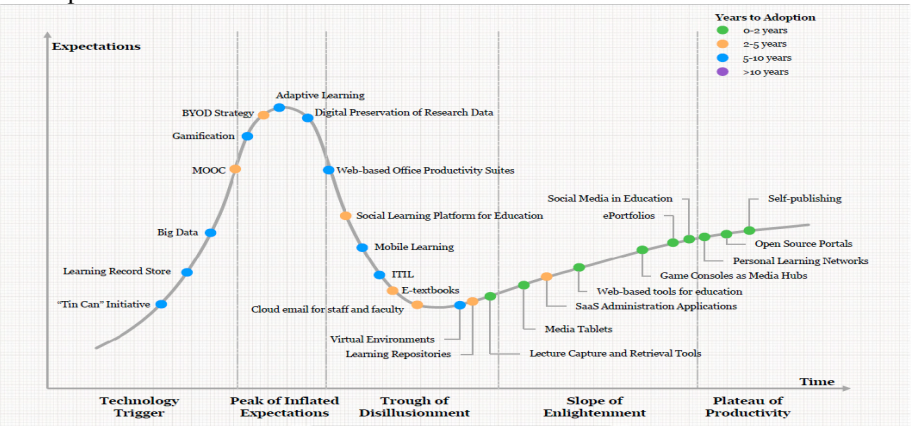

Fig. 1. A European perspective on e-Learning (IBIS Capital, 2013)

4.2 Moodle Learning management system - new features

We are planning to use the Moodle system for e-learning in the project regarding to our good experience, the system references, functionality and some new feature. We just would like to highlight some new feature which will be useful in the project.

- Responsive Design, Learning on the Go
- Power up the Cloud
- Big Data

- Mobile Notifications.

Moodle are continually improving their responsive themes, this will allow Moodle to be used for learning on tablets, phones and other mobile devices. The core Moodle theme is based on Bootstrap and Webanywhere recommends all users migrate to a responsive theme to allow learners to access Moodle on the go. The Moodle Bootstrap theme is now the default for any new installation of Moodle. Given Moodle is the largest online Learning Management System globally with over 80 million users, scalability is essential as larger companies look to deploy the solution for their workforce. System administrators will find more features than ever which will enable them to scale Moodle to millions of learners if required (Ghirardini, 2011). What this means is that the Learning and Development professionals will be able to pull more information out of the Moodle environment about learning experiences. This feature is using the logging framework, and, this will allow the Moodle community to build on top of the framework to enable better reports to be gathered.

The Moodle server is used as virtual collaboration space and e-learning system. The system implemented at 09/01/2014. We created the initial structure for collaborative work and starting the e-learning courses, but this year restructured it base on the English project partner's proposals. This time 136 users are registered (enrolled) in the system. From this there are 70 enrolled students.

4.3 Vidyo, Mooc and videotorium

VidyoDesktop system extends high-quality video conferencing to different platforms of computers, allowing users on these systems to participate at their office, from home. With support encoding at resolutions up to full HD and dual-screen multipoint video, VidyoDesktop delivers a first-class conferencing experience to any workspace. VidyoDesktop extends high quality conferencing and collaboration to virtual desktop and thin client environments.

A massive open online course (MOOC) is an online course aimed at unlimited participation and open access via the web. In addition to traditional course materials such as videos, readings, and problem sets. MOOCs provide interactive user forums that help build a community for students, professors, and teaching assistants (Brahimi and Sarirete, 2015). MOOCs are a recent development in distance education which began to emerge in 2012. Early MOOCs often emphasized open access features, such as connectivism and open licensing of content, structure and learning goals, to promote the reuse and remixing of resources. Some later MOOCs use closed licenses for their course materials while maintaining free access for students. On the Fig. 2. can be seen the evolution of MOOC.

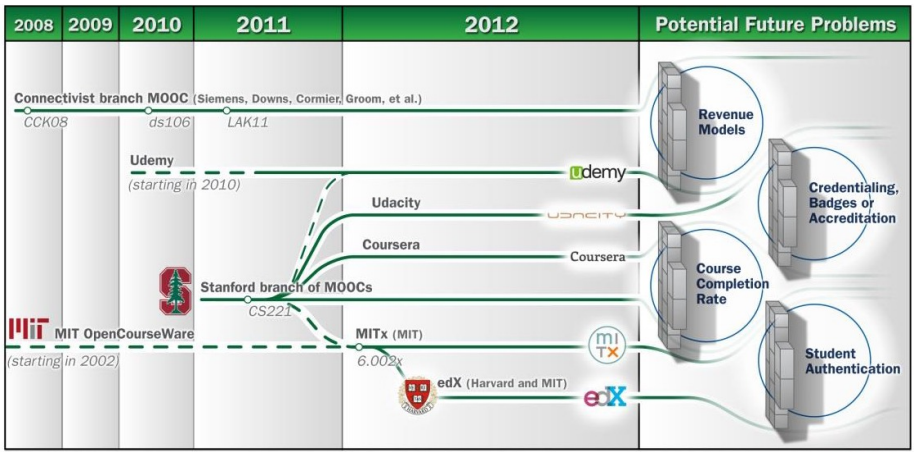

Fig. 2. Evolution of MOOC (Hill, 2012, Gaebel, 2013)

Videotorium would like to meet special requirements of higher-education, research and public collections community, which would be rather difficult to satisfy by a general video sharing portal. Major features briefly:

- Sharing of audio- and video recordings.
- Uploading and synchronize slides to the recording of your speech.
- Organisational micro sites: present all recordings of your institution through an own Videotorium site with individual URL, design and news.
- Flash based playback, compatibility with all popular browsers.
- Live streaming: broadcast your event live through Videotorium to deliver your event to thousands of users through our high capacity servers.

We are testing this system for storing and streaming videoconferences on-line lectures (on-line learning, Fig 3.).

4.4 Knowledge Base Systems

A knowledge base or knowledge bank is a special kind of database for knowledge management. A knowledge base is an information repository that provides a means for information to be collected, organized, shared, searched and utilized. It can be either machine-readable or intended for human use. Behind a Knowledge Data Bank (KDB), there is, at least, a back-end which is a DBMS.

The developed system architecture can be seen on the Fig. 4.

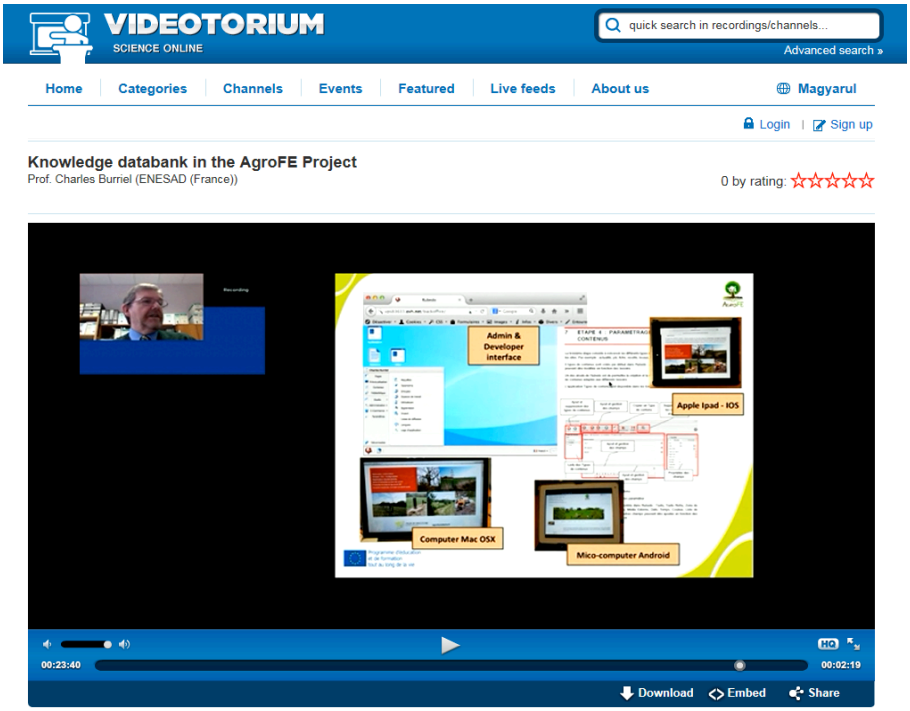

Fig. 3. Playing the lecture from the auditorium

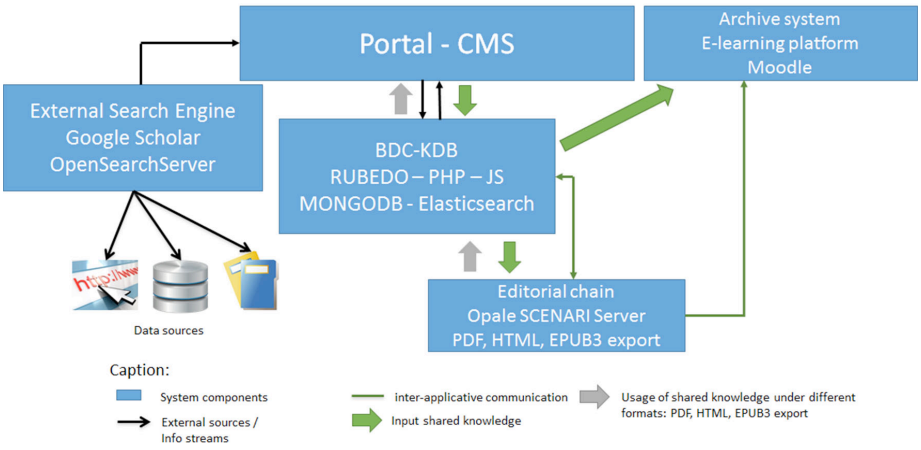

Fig. 4. Knowledge Base System architecture

In the context of the AgroFE project, the Technologies of Information and Communication, ICT, include four components, the collaborative tools (OTC-CWS), the Knowledge Data Bank (KDB-BDC), the tools for training and archiving and a portal that integrates the tools.

Under the project, these documents are identified, selected, proposed by partners and included into the KDB for the evaluation of their potential use in training, by one

or more partners. A fact sheet originally written by the proposer, the institution, who proposed it to project partners, often accompanies, completes this document.

At the end of the evaluation phase, the KDB can be extended to other contributors, for other uses, such as exchange supports between different actors of Agroforestry.

In computing, a database is gathering highly structured data, a well-defined organization, based on different types of structures: Relational, hierarchical. This is absolutely not the case in a databank in which we store structured tables of numbers as well as illustrated text or video or emails, external knowledge or those from the project, in their various forms. But it should be noted that the knowledge data bank in the prototype of the AgroFE project is based on a software, RUBEDO, developed in PHP and RUBEDO is built on different components.

4.5 Hungarian specialties in the project

4.5.1 Developing Agroforestry in Agri-Environment course

The agroforestry will be important for rural areas and farms according to more aspects. Environmental, economic, agricultural production, rural living are very important issues. The project participants are involved in to developing curricula for more training levels. Up to now we have developed subjects for BSc and MSc level in “Agroforestry” which accepted by two faculty boards, the latest version of the Moodle system has been implemented for collaborative space and we carried out more virtual meetings by the new videoconference systems, which have been tested and used more times.

The main topics are the following: National and international practice of agroforestry, Natural science of agroforestry, Watershed management of agroforestry, Flood protection of agroforestry, Mitigation of water erosion in agroforestry practice, Mitigation of wind deflation in agroforestry practice, Ecological animal husbandry and agroforestry, Grassland management and agroforestry, Ecological crop-production and agroforestry, Phytoremediation and agroforestry, Energetic wood plantation, Local governance of agroforestry, Low and justice of agroforestry, Informatics of agroforestry.

The documentation of the course was prepared for Faculty Council of University of Debrecen to accept it, which was supported unanimously. The declaration of the course was carried out in the digital educational system in order to the students could start the registry from the September 2014.

4.5.2 The Agricultural Informatics International conferences (2013 and 2014)

On the Agricultural Informatics 2013 (AI2013) Conference on 8 of November at the plenary session held a presentation by Prof. Charles Burriel. The title of his presentation was ” Proposal for a new approach of accredited credits in American University = The UIUlink platform ". The presenter spoke about the system, which are massive, open, on-line and focuses the courses. The UIU link are accredited, certified, on line at the market place and the student proposed his professor, who can

decide the accepting or refusing. The UIU link is expend the teaching to new student who cannot be on campus and expend the relationships with high level partners everywhere in the world.

There were 150 participants from 7 countries at the conference. Leading domestic and international professionals gave 11 plenary lectures on the site of the Conference (University of Debrecen, Hungary). Subsequently, professors from the University of Florida, Wageningen University, University of Bonn and Prof. Charles Burriel gave videoconference plenary lectures. In the sessions 46 lectures were given by some 100 authors and co-authors. The Conference program, presentations, photos and exhibition posters can be viewed on the conference site http://nodes.agr.unideb.hu/ai2013/ .

On the second day of the conference, 9 of November 2013 at 9 am we organized a workshop with the primary purpose of the tasks discussion in the AgroFe Leonardo Project and clarify and refine the tasks of the Hungarian partner and review of expectable proposals and opportunities in the field of Agricultural Informatics between 2014-20. On the workshop Prof. Charles Burriel was an invited speakers, who gave a presentation, which title was "Development of Knowledge Data Bank (KDB) for secondary, higher, and professional education and training, and professional usages". In the presentation we could get detailed information of the project to be achieved by KDB and the related open-source software tools (WordPress) and reported on the possible usages of the system in the AgroFe project. The presenter spoke about the concept of KDB, what is the Knowledge Data Bank and what is the architecture of the KDB. He spoke needs analysis and required components of KDB.

On the Agricultural Informatics 2014 (AI2014) on 13 of November at the plenary session, which was followed parallel sessions. The main objective of the conference is to promote the exchange of experiences among non-profit, research and business professionals, as well as the development of the international relations. The event provides a forum for agriculture involved practical and academic players, to discuss the actual questions of education, research, development and application of Information Technologies in Agriculture and Rural Development. The meeting covers a broad range of topics, as follows: Big data, Information systems, Bioinformatics, Cloud computing and services, Collaborative working environment, Decision Support Systems, Modelling and simulation, , Ecological modelling, Education/Training programs and development, E-learning, Food safety and traceability, Future Internet in the agri-food sector, Information and communication technologies for rural areas, Information systems, IT and innovation in agri-food sector, Mobile technology applications, Precision agriculture, GIS, RS, Web services, portals and Internet applications, Wireless sensor networks.

4.5.3 Field study

In the framework of transnational meeting was organised an agroforestry field study at the National Agricultural Research and Innovation Centre, Forest Research Institute (NARIC FRI).

The NARIC FRI has a 115 year-old experience in the research related to forest management and tree breeding. Six stations belong to the Institute in Sárvár,

Budapest, Mátrafüred, Püspökladány, Sopron and Szombathely. It manages three arboretums and an ecocamp. Our destination was Püspökladány, which is located 50 km from Debrecen. The basic activity of the FRI is doing research but it also has expertise, equipment, plant material produced as a result of research that can be further utilized or marketed. Water, soil and biomass analysis performed in the ecological laboratory facilitate first of all research but they also have marketable capacity in the field of soil analysis and soil consultancy. Besides breeding and genetic conservation, seedlings and cuttings are produced. FRI shares its knowledge with foresters about growing techniques, economic evaluation, and forest protection in professional meetings and exhibitions.

The field study was a half day programme there, where Csiha Imre director took a general introduction about agroforestry (Fig. 5). This follow three different practical exhibition:

- Dendrology - measuring tree height, estimation of tree mass (leadership of exhibition: Kovács Csaba and Bozsik Éva)
- Hidrology and soil science in agroforestry (leadership of exhibition: Rásó János and Riczu Péter)
- Landscape management - Ágota-puszta, Hortobágyi National Park (leadership of exhibition: Prof. Dr. Blaskó Lajos and Gálya Bernadett).

Fig. 5. Pictures about the field study in Püspökladány

5 Conclusion

The agroforestry will be important for rural areas and farms according to more aspects. Environmental, economic, agricultural production, rural living is very important issues. The project participants are involved in to developing curricula for more training levels on different (L4/L5/L6) levels. The latest version of the Moodle system has been implemented for collaborative space and we carried out more virtual meetings by the new videoconference systems, which have been tested and used more times. All the virtual meetings have been recorded in the Videotorium system. We are convinced that using the innovative technologies and solutions the system will serve and support to achieve the project goals. Analyzing the open source tools we have created the architecture of the knowledge base and service system for harvesting materials, building knowledge base and information service, implement e-learning service in agroforestry. The Knowledge Data Bank and service system is developing and will be finished in this year. Finally is introduced the Hungarian specialties in the projects like education, subject about agroforestry, conference and workshops and field trip in Püspökladány.

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Evaluation of an Irrigation Water Treatment Technology (MAXGROW) on its Effects to Vegetable Species Yield

Athanasios Gertsis[1], Konstantinos Zoukidis[2] and Christos Vasilikiotis[2]

[1]Department of Environmental Systems Management, Precision Agriculture Laboratory, Perrotis College, American Farm School, Thessaloniki, Greece, e-mail: agerts@afs.edu.gr
[2]Department of Environmental Systems Management, Precision Agriculture Laboratory, Perrotis College, American Farm School, Thessaloniki, Greece

Abstract. Irrigation water quality became worst in terms of increasing its salinity and causes severe problems in many cultivated crop species, resulting in lower yield. In addition, the scarcity of irrigation water due to overuse or runoff is another limitation for increasing food and feed production. Saline water treatment technology offers potential solutions; however this technology is yet expensive and not cost effective for large scale. This study evaluates a water treatment technology (MAXGROW) using ultra sound for treating saline water, for its potential to minimize effects of saline irrigation water and its possible effects of crop productivity. A greenhouse study in pots was undertaken using two substrates (a sandy loam soil and a mixture of pumice and a composted material), four vegetable species (green onions, spinach, radishes and arugula) which were irrigated with two qualities of irrigation water (a highly saline and a regular irrigation water) treated and untreated with the MAXGROW technology. The results showed an increased yield caused by the treated saline water in almost all species and in both growth substrates. The potential of this device was shown to be promising and it is currently under continuous evaluation using more species and higher salinity level irrigation water. Irrigation water efficiency is a potential deliverable from the system.

Keywords: saline water, desalinization, MAXGROW system, vegetables, irrigation efficiency

1 Introduction

The scarcity of fresh water in arid and other regions necessitates use of saline water as a valuable alternative input for crop irrigation. Saline water has an agricultural potential but it is necessary to develop special management techniques and use of special water technologies, to obtain optimal yield and maintain high quality of commercial products. Field experiments, which were carried out in a pear orchard, have shown that by using saline water through subsurface drip irrigation (SDI) reasonable yields can be obtained (Gideon et al., 2002). Saline water use for agricultural production offers several additional benefits: (1) re-use (instead of

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disposal as with fresh water) during the entire year, with minimal environmental risk of groundwater deterioration (Oron, 1993); and (2) a premium market price for the fruits and vegetable products because of a high content of total soluble solids and an extended shelf life, due to the adaptation of the plant to the stressful growing conditions (Mizrahi & Pasternak, 1985)

Salinity is one of the major abiotic stresses that adversely affect crop productivity and quality. About 20% of irrigated agricultural land is adversely affected by salinity (Flowers and Yeo, 1995). Progress in breeding for salt-tolerant crops has been hampered by the lack of understanding of the molecular basis of salt tolerance and lack of availability of genes that confer salt tolerance. Most crop plants are susceptible to salinity even when ECe is _3.0 dS m^{-1} which in terms of osmotic potential is less than –0.117 MPa (osmotic potential =0.39 x ECe). At these salinity levels, the predominant cause of crop susceptibility appears to be ion toxicity rather than osmotic stress (Chinnusamy et al., 2005) Throughout the world, water scarcity is being recognised as a present or future threat to human activity and as a consequence, a definite trend to develop alternative water resources such as desalination can be observed. The most commonly used desalination technologies are reverse osmosis (RO) and thermal processes such as multi-stage flash (MSF) and multi-effect distillation (MED) (Fritzmann et al., 2007). Little information is available about the ability of horticultural crops to detoxify reactive oxygen species and to synthesize compatible solutes and hence on the potential contribution of these mechanism to induce salt tolerance in horticultural crops (Paranychianakis and Chartzoulakis, 2005). The U.S. Geological Survey (8) Gleick, 1996) found that 96.5% of Earth's water is located in seas and oceans and 1.7% of Earth's water is located in the ice caps. Approximately 0.8% is considered to be fresh water. The remaining percentage is made up of brackish water, slightly salty water found as surface water in estuaries and as groundwater in salty aquifers. Water shortages have plagued many communities, and humans have long searched for a solution to Earth's meager fresh water supplies. Thus, desalination is not a new concept; the idea of turning salt water into fresh water has been developed and used for centuries (Greenlee et al., 2009()**.** Most of the technologies used to treat saline irrigation water are expensive. There is not adequate information on simple and yet effective technologies to utilize saline water and sustain crop productivity. The objective of this study is to evaluate in a long-term and in various crop species and substrates, the efficiency of the MAXGROW technology system, using highly saline irrigation water (treated and untreated) and its effects in crop productivity and changes in substrates chemical properties, mainly pH and Electrical Conductivity (EC).

2 Materials & Methods

The study is a long-term assessment and the first set of yield results are presented herein. The experiment was set in a greenhouse, using 15-liter black PE pots filled with two "substrates": 1.a sandy loam soil and 2. a mixture of medium size pumice with a composted material (by BIOSOLIDS) in a volume ratio of 4:1. Within each substrate, two irrigation water qualities treatments (each treated and untreated by the

device) were set: a mixture of sea water with regular water with an Electrical conductivity (EC) of ~8.0 dS/m and a regular irrigation water with an EC~0.7 dS/m. Four lines of 20 pots each per substrate were formed, with the following arrangement: Line A=Treated with the MAXGROW device irrigation (High salinity water) Line B= Treated with the MAXGROW device irrigation (regular salinity water) Line C= Non Treated with the MAXGROW device irrigation (High salinity water) and Line D= Non Treated with the MAXGROW device irrigation (regular salinity water). There were 160 total pots with 5 replications for each of the imposed treatments (Figure 1).

The MAX GROW is an electronic water treatment system (Figure 2) using multiple transmissions of low radio frequencies to tackle the problems caused by saline water. It works by generating up to million vibrations per second and it differentiates the mineral salts to produce safe, easily removed by-forms. The device transmits radio waves in constantly altered frequencies, which dissolve totally the calcium carbonate ions in water. It transmits radio waves in constantly variable frequencies which are programmed automatically, virtually every tenth of a second from the device itself based on a mathematic algorithm.

Four vegetable species sensitive to salinity used:

1. Green onions (*Allium cepa*) 2. Spinach (*Spinacia oleracea*) 3. Arugula (*Eruca sativa)* and 4. Radishes (***Raphanus sativus***) and they all received equal and minimum fertilizer and no pesticides were used. At maturity stage for each species, the fresh yield was harvested and weighted. Soil properties measured included pH and ECs (using 1:1 ratio of d. water and substrate) C electrode, in the beginning (before any water treatment) and at the end of the first cycle of plants grown.

Means comparisons using Student's *t* test was conducted using JMP 8 statistical software (www.jmp.com), wit in each main and secondary treatment. Samples from each substrate were analyzed for pH and EC in the beginning and at the harvesting time.

Fig. 1. The layout of the greenhouse study with the four vegetables used.

Fig. 2. The MAXGROW water treatment technology system used

3 Results & Discussion

3.1 Yield results

The four species used received minimum chemical fertilizer. The data analyses for yield are presented in Table 1, pooled across all treatments and separately for each of the two substrates and each plant species within each, and for the four water irrigation type treatments (saline & regular water, treated & untreated).

The saline water treated with the MAXGROW device increased statistically the yield in many cases, while it was in all cases of the higher yielding types. The only crop that was not affected by irrigation type was spinach in the sandy loam soil. In the sandy loam substrate, the saline water treated produced the highest yields in all four crop species (spinach, radish, green onions and arugula), while in the Pumice+Compost substrate the yield was among the top in all crop species but not as high and significant as in the sandy loam substrate. The real cause of this is not clear yet, but it is hypothesized that the system provides a high level of break-down of macromolecules of various salts, making them more transportable through the plant cell membrane system. This hypothesis can be further tested using sophisticated microscopy techniques and additional validation studies, which are in progress.

Table 1. Yield results for each substrate, irrigation type and plant species

SUBSTRATE	Irrigation type	Crop species	Fresh Yield (g/pot)	Statistical significance*
Pumice+Compost	Saline water-Treated	Arugula	195,4	ab
Pumice+Compost	Regular water-Treated	Arugula	203,6	a
Pumice+Compost	Saline water-Non treated	Arugula	180,2	ab
Pumice+Compost	Regular water-Non treated	Arugula	171,8	b
Sandy loam soil	Saline water-Treated	Arugula	176,2	a
Sandy loam soil	Regular water-Treated	Arugula	135,4	b
Sandy loam soil	Saline water-Non treated	Arugula	124,6	bc
Sandy loam soil	Regular water-Non treated	Arugula	106.0	c
Pumice+Compost	Saline water-Treated	Green onions	106,8	ab
Pumice+Compost	Regular water-Treated	Green onions	81,8	b
Pumice+Compost	Saline water-Non treated	Green onions	115,2	a
Pumice+Compost	Regular water-Non treated	Green onions	92,6	ab
Sandy loam soil	Saline water-Treated	Green onions	142,8	a
Sandy loam soil	Regular water-Treated	Green onions	97,4	b
Sandy loam soil	Saline water-Non treated	Green onions	101,4	b
Sandy loam soil	Regular water-Non treated	Green onions	142,8	a
Pumice+Compost	Saline water-Treated	Radish	70,6	b
Pumice+Compost	Regular water-Treated	Radish	82,2	ab
Pumice+Compost	Saline water-Non treated	Radish	106,6	a
Pumice+Compost	Regular water-Non treated	Radish	89,4	ab
Sandy loam soil	Saline water-Treated	Radish	129,6	a
Sandy loam soil	Regular water-Treated	Radish	70.0	b
Sandy loam soil	Saline water-Non treated	Radish	34,8	c
Sandy loam soil	Regular water-Non treated	Radish	63,4	b
Pumice+Compost	Saline water-Treated	Spinach	77,4	ab
Pumice+Compost	Regular water-Treated	Spinach	57,2	b
Pumice+Compost	Saline water-Non treated	Spinach	100,6	a
Pumice+Compost	Regular water-Non treated	Spinach	63,6	b
Sandy loam soil	Saline water-Treated	Spinach	129,2	a
Sandy loam soil	Regular water-Treated	Spinach	112,4	a
Sandy loam soil	Saline water-Non treated	Spinach	130,4	a
Sandy loam soil	Regular water-Non treated	Spinach	110,2	a

* Treatments not connected by same letter are significant different (Student's *t* test)

In addition to yield measurements, some preliminary sensory characteristics were prematurely evaluated from a panel of 10 people and the general consensus was that the crops irrigated with saline water had a more "spicy" and pleasant taste compared with those irrigated with regular water. The panel's opinion was based on the taste of the "control" plants considered to be the plants irrigated with regular water untreated.

3.2 Soil properties results

Table 2. The soil properties as affected by the quality of irrigation water, at the harvest stage.

Substrate	Irrigation type	pH	ECs (dS/m)
Sandy loam soil	Saline water-Treated	7.7	2.315
Pumice+compost	Saline water-Treated	7.7	2.265
Sandy loam soil	Regular water-Treated	7.8	0.780
Pumice+compost	Regular water-Treated	7.8	0.935
Sandy loam soil	Saline water-Non treated	7.7	1.585
Pumice+compost	Saline water-Non treated	7.6	2.085
Sandy loam soil	Regular water-Non treated	7.8	0.670
Pumice+compost	Regular water-Non treated	7.8	0.445

The results from the two soil properties (pH, EC) initially evaluated (Table 2), indicated that the water treatment system did not affect the soil's reaction (pH), while there were differences on the electrical conductivity (ECs); however, the levels of EC are not considered yet to be of any potential risk since most plant species can tolerate these levels (Maas and Hofman, 1997). The two properties will be continuously monitored in the next phases of this study and for a long period, in order to record the short and long term changes in both properties.

4 Conclusions

This phase of the study provided initial data for comparisons between saline and regular water (treated and untreated with the MAXGROW system) used for irrigation. The results have shown that the saline water treated by the MAXGROW technology increased yield and in many cases the increase was statistically significant. Therefore, this technology can be efficiently used to irrigate the four species using high EC (salinity) lever irrigation water. The long term effects on the examined and other crop species are under evaluation, for further validation of the trends and results shown in this phase. Also, the level of salinity will be progressively increased. The benefits of the device can be translated in positive economic outputs. A financial analysis will be provided in a follow up study. The

short and long term benefits are expected to be substantial, in terms of the reduction of fresh water supplies for irrigating crops or use of high EC irrigation water for efficient irrigation.

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Green Entrepreneurship and Green Products: Consumers' Views and Attitudes in Regional Unit of Evros

Garyfallos Arabatzis[1], Spyros Galatsidas[2], Christina Intze[2], Miltiadis Chalikias[3], Stavros Tsiantikoudis[2], Spyros Mamalis[4]

[1]Department of Forestry and Management of the Environment and Natural Resources, Democritus University of Thrace, Orestiada, Greece, e-mail: garamp@fmenr.duth.gr
[2]Department of Forestry and Management of the Environment and Natural Resources, Democritus University of Thrace, Orestiada, Greece
[3]Technological Education Institute of Piraeus, Department of Business Administration, Piraeus, Greece, e-mail: mchalikias@hotmail.com
[4]Eastern Macedonia and Thrace Institute of Technology, Department of Business Administration, Kavala, Greece, e-mail: mamalis@con.auth.gr

Abstract. Environmental challenges consider to be directly related with issues of economic growth and firms have to play crucial role in sustainable development. European environmental policy aims, among others, in the creation of a favorable framework for the development of green entrepreneurship. The research was carried out in Evros regional unit using questionnaire. The aim of the study is to investigate the views and attitudes of the consumers about green entrepreneurship and green products. The sample was 400 consumers. The results show that the majority of the respondents know about green entrepreneurship. The green products offer competitive advantage to the firms and more specifically organic products are the most popular among the respondents.

Keywords: green entrepreneurship, green products, consumers, environment

1 Introduction

Adopting a sustainable way of environmental management is an alternative of moderating environmental impacts caused by entrepreneurship activities (Boiral, 2006; Haden et al., 2009). Precautionary environmental management can be achieved by adopting various techniques as to create green products (Nielsen and Wenzel, 2002; Pujari et al., 2000; Fuller and Ottman, 2004), establishing clean technology (Kuehr, 2007) and using environmental management systems (Ghisellini and Thurston, 2005) aimed at environmental awareness.

Adopting practices for creating green businesses and products, besides environmental and social benefits, has in any cases benefits for businesses as many

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consumers prefer those with socially responsible name (Skordoulis et al., 2013; Ntanos et al., 2014).

The objective of this research is to investigate the views and attitudes of the consumers in Evros regional unit related to green entrepreneurship and green products.

2 Theoretical background

2.1 Green Entrepreneurship and Green Products

Green entrepreneurship is defined as the effort to minimize environmental footprint, namely the total environmental and social cost resulting due to human entrepreneurship activity (Hall et al., 2010).

Green firms are aware of the cost, innovation and advantages of the marketing and seek for a social and moral change in entrepreneurial sector. There are two kinds of firms, these that produce green products and those that are using green techniques in the productive line. All the kinds of green firms contribute in a sustainable society (Guziana, 2011).

European environmental policy enhances green market development releasing suitable guidelines and directives, a framework essential for entrepreneurs that are interested in establishing green firms. Good environmental quality depends on technological innovation large industries use in order to manage environmental problems that arise by themselves and one of these is waste management. They can deal with above need by establishing a green firm (Cope, 1988).

2.2 Consumers' Attitudes for Green Products

Consumer's attitude is a combination of mental and physical activities in an effort to seek and evaluate market and use of products and services (Cole, 2007). Fiedler and Wanke (2001) recognize that net economic variables, like income, associated with consumption, while other important elements are their feelings and perceptions. (Bagozzi and Dholakia, 1999).

The environmentally friendly consuming attitudes include issues related in selecting environmentally friendly products and in avoiding non – environmentally friendly products. Hasnelly and Sari (2012) stated that consumers buy a product according to their perception about its value. The consumer group where an individual fits, according to his or her preference strongly influences the decision to buy a green product. Consumers that are likely to buy green products mostly are in the group called "Millenials", etc. between 18 and 40 years old (Skordoulis et al., 2013; Ntanos et al., 2014).

In some cases consumers have the willingness to pay more for ecological products, recycling, green products or green package for a product (Mathur and

Mathur, 2000). In other studies consumers are willing to buy products produced through green techniques, although this situation is more likely to happen when these products are not more expensive than conventional ones (Skordoulis et al., 2013; Ntanos et al., 2014).

3 Research methodology

The research was conducted in Evros regional unit, Greece using a questionnaire. The area has some of the rarest and valuable natural resources in Greece with important development perspectives in the primary and tourism sector (Arabatzis and Grigoroudis, 2010; Grigoroudis et al. 2012).

This study is based on primary data and is developed in two levels. The first one includes the results of a quality research conducted during September to December 2013. In this period researchers approached certain consumer focus groups. The second one includes quantity research. This research conducted from January till April 2014 using a questionnaire based on the previous quality research. We collected 400 questionnaires in total.

4 Results

4.1 Socio-demographic Characteristics

The sample of the research presents the following characteristics: 42.5% was men and 57.5% women. Most of the respondents were between 31-40 years old (35.5%), following by the respondents whose age was between 21-30 (32.25%). Lower percentages were ages between 61-70 (3.5%) and over 70 (2.75%). Mean average age is 37 years. As far as their marital status nearly half of them are married (49.0%) and 41% single.

About their educational level the majority of the respondents has finished secondary education (36.5%) and 29.5% has finished tertiary education. Only 3.5% has not graduated primary school while 9.3% has graduate primary school and finally the rest of the respondents have finished technical secondary education. Nearly 60% of the respondents (59.9%) are wage earners (civil servants, private employees, workers, retired), 21.8% are depended economically by others (unemployed, housekeepers), 12.3% are free lancers and 6.3% are students. The fact that most of the respondents are civil servants highlights their willingness to buy things and their attitude towards green markets and green products.

Finally, about their monthly income most of the respondents earn from less than 600.00 € to 1,000.00 € (66.8% in total), 21.5% earn 1,001.00 to 1,500.00 €, 5,8% have an income that is averaged from 1,501.00 to 2,000.00 €. Only 2.5% have an

income that is between 2,000.00 € and 2,500.00 € and 2.8% an income over 2,500.00.

4.2 Knowledge and Attitudes Towards Green Entrepreneurship

In the question concerning the knowledge respondents have about green entrepreneurship, the majority of them (66.8%) stated familiar about it.

The most significant types of green entrepreneurship are "production and selling of organic farming products" (32.75%) and "production and selling of protected areas certified products" (22.5%).

Table 1 shows various environmental management systems that most of the firms have to apply in their production process. Respondents believe that a "national or local environmental management system" (36.8%) is, by far, the most appropriate in order to buy similar products.

Table 1. Main environmental management systems

Environmental Management Systems	Frequency	(%)
National or local management system	147	36.8
ISO 14001	59	14.8
ISO 16000	62	15.5
EMAS	59	14.8
ISO 14064	48	12.0
Other	25	6.3

4.3 Barriers and Incentives for Green Entrepreneurship

Green entrepreneurship considers being a form of social return as respondents consider that this kind of entrepreneurship aims in maximizing social benefit (38.3%). Approximately one fourth of the respondents consider the above statement as "very much" (24.8%) and another 25.5% as "moderate".

Additionally, respondents tend to believe that a friendly environmental behavior by a firm could improve its image to the other people.

As far as green techniques consider a source of innovation or are directly related with it, 21.3% stated as "very likely", while 44.3% "likely".

Respondents consider the "development of competitive advantage" as the main motive of a firm to offer green products (21.0%).

4.4 Consumer Attitudes Towards Green Products

Significant percentage of the respondents (33.75%) stated that they buy "sometimes" green products, when they go shopping, 29.25% answered "rarely",

about 22.5% buys green products “frequently”, 11.5% “never” buys green products and only 3.25% stated that buys “always”.

About their willingness to pay for green products, a large percentage of the respondents (61.5%) stated that they are not willing to pay more in order to buy a green product. The reason lies in the current financial situation of the households where most of them are not in place to spent more money as they would like to do.

People distinguish main elements that differentiate green products from others in their mind. The first of all is the “quality” of a green product (49.0%) following by its price in the market (30.3%). These two characteristics shows that our sample is not differentiate compared to other similar studies, as the relation between quality and price was always determinant in purchasing products. Other factors that characterize green products in a lower degree are its “label” (13.0%), its color (3.5%), brand name (3.0%) and the “design” of the package in which merchants offer the product (1.3%).

5 Conclusions

According to the results of the research we conclude that most of the respondents are familiar with the concept of “green entrepreneurship”. Also they consider that firms producing green products, in order to reduce their expenses and to use natural resources in a sustainable way, must adopt techniques of saving energy use. Respondents consider the “production and offering organic products” as the most common type of green entrepreneurship.

The participants in the research consider that green entrepreneurship aims “very much” in maximizing social benefits, while the adoption of green techniques in production line can enhance the firm’s image. “Competitive advantage” is the most significant reason of a firm to produce and offer green products to the market.

In the context of Evros regional unit it is obvious that local authorities and central government must provide additional motives in developing green entrepreneurship in the area as there are many natural resources not exploited yet. Green entrepreneurship, especially in remote and less developed areas like Evros can play crucial role in vitalizing local economy.

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Posters

E-learning Course in Organic Food Retailing in Bulgaria

Mariana Ivanova[1]

[1]University of Agribusiness and Rural Development, Plovdiv, Bulgaria,
e-mail: mivanova@uard.bg

Abstract. The current paper presents results from the Transfer of Innovation Project titled: "ECVET-based training of trainers in organic food retailing to „EcoQualify" Quality Assurance System" (ECVET-EcoQualify, № 2013-1-BG1-LEO05-08698). The main project aim is to create an e-learning training course for teachers/trainers and tutors/instructors oriented to offer them the abilities needed to design, plan and distribute training courses based on the European Credit System for Vocational Education and Training (ECVET) and the European Qualification Framework (EQF) in a very specific subject field - organic food retailing. The paper presents the structure of the e-learning course, the main topics in the training contents, etc. based on the "EcoQualify" Quality Assurance System and following the EQF and ECVET-learning outcomes approach. The e-learning course is available in the following languages: English, Czech, German, Bulgarian, Italian and Turkish. The e-learning platform has been created and administered by Forum Berufsbildung – Germany.

Keywords: organic food retailing, e-learning, ECVET, EQF.

1 Introduction

Organic food retailing is one of the fast growing sectors of the European economy. Moreover, consumers' interest in organic products has risen in the last years (Ivanova, 2012). Therefore, the issue of educating managers and shop assistants is gaining more and more importance. However, this sector is suffering from a severe lack not only of qualified personnel, staff and managers, but also of well qualified teachers and trainers who provide training in that field (Ivanova, 2013). The main objective of the ECVET-EcoQualify project is to create a training course for teachers/trainers and tutors/instructors oriented to offer them the abilities needed to design, plan and distribute ECVET and EQF-based training courses in the field of organic food retailing. The e-learning course demonstrates how to apply the Methodology for EQF and ECVET-based training course for organic food retailing paying attention to the development in NQF in each of partner countries. The e-learning course is available in the following languages: English, Czech, German, Bulgarian, Italian and Turkish. The e-learning platform has been created and administered by FORUM Berufsbildung – Germany. For Bulgaria, this is the first e-learning course in the field of organic food retailing.

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2 Methodology

The e-learning course demonstrates how to apply the Methodology for EQF and ECVET-based training course for organic food retailing paying attention to the development in NQF in each of the partner countries.

The methodology applied is based on an integrated approach taking into consideration the following main aspects:

a) Learning outcomes definition criteria coming from EQF / ECVET regulations and methods, as it was analyzed and applied in previous Leonardo da Vinci Partnership Project;

c) ECVET criteria to evaluate and assign credit points, taking into account the complexity, scope and volume of learning outcomes in the unit, effort necessary for a learner to acquire the knowledge, skills and competence required for the unit, as clearly stated in the official study of EU Commission "The European Credit System for Vocational Education and Training"" (ECVET). ("Get to know ECVET better Questions and Answers" (February, 2011).

The following communication tools are used:
- Working meetings of the project management team, including consultants;
- Consultation via e-meetings;
- Information and advisory inputs by e-learning and e-training experts.

3 Project Partners, Target Groups and Sectors

3.1 Project partners

- University of Agribusiness and Rural Development (UARD), Bulgaria – Contractor and Coordinator
- Organic Retailers Association (ORA) – Austria
- Zivy Venkov – Czech Republic
- FORUM Berufsbildung. e .V. – Germany
- Ökomarkt e.V. Hamburg – Germany
- Institut Equalita – Germany
- Associacione Terre dell' Adriatico (ADRIALAND) – Italy
- Canakkale Onsekiz Mart University – Turkey
- Education Research Association (ERA) – Turkey

3.2 Target groups and sectors

ECVET-EcoQualify project addresses the Priority titled: Support to initial and continuous training of VET teachers, trainers, tutors and VET institution managers (LEO-TraInno-8). The target group includes teachers and trainers, VET providers of

services and trainers in the field of lifelong learning. The target sectors are education, agriculture, organic trade and retailing, ecological field and food safety. In fact, we refer in particular to a very specific sector – organic food retailing which is characterized with a gap of well qualified teachers/trainers and tutors.

4 E-learning contents – description of the main e-learning course documents

4.1 E(co)-Qualify Quality Assurance System

E(co)-Qualify is a comprehensive European Quality Assurance System for further education in the area of organic food retail. It offers a basis for meaningful assessment and certification systems and contributes to the alignment of different training and evaluation systems. (Ivanova M., D. Dimitrov, et al., 2013).

4.2 Methodology for EQF and ECVET-based training course for organic food retailing

The document outlines the methodology on EQVET units and credits attribution, leading to the integration of E(co)-Qualify qualifications into ECVET. The strategy is a bottom-up approach (from the work and market sector to educational and training activities) assuring the transferability of the project results to other sectors where informal and non-formal knowledge is concerned. It identifies basic units and points able to establish a shared credits system for transferring recognized qualifications in different European countries vocational and educational contexts. The E(co)-Qualify qualifications credit system identifies corresponding learning units and credit points for each qualification level, with the goal to make the E(co)-Qualify qualifications identifiable for implementation across Europe.

4.3 Learning Outcomes

The document contains detailed description of Key Units and Learning Outcomes by Professional Profiles, following the EQF/ECVET methodology.

Learning outcomes are defined as statements of what a learner "knows, understands and is able to do" after a learning process. The categories are: 1/ Knowledge; 2/ Skills; 3/ Competence. They can be used for different purposes. For example as descriptive units for the qualification frameworks, in order to define qualifications, design curricula and make assessments. They exist on different levels and in different quality according to their precision.

4.4 Guidelines for VET Institutions in organic sector

The Guidelines define the didactics and practical instructions for training of teachers in organic sector following the EQF and ECVET learning outcomes approach.

5 Training course components

5.1 Component 1 – Learning outcomes

Learning Outcomes are grouped in "Units". A unit of learning outcomes (also called “unit” or “module”) is a component of a professional profile consisting of a coherent set of knowledge, skills and competence that can be assessed and validated. This presupposes that the units of learning outcomes are structured comprehensively and logically and that they can be examined. Units of learning outcomes can be specific to a single professional profile or common to several.
The description of qualifications in terms of units of learning outcomes is one of the main elements of ECVET.
The **units of learning outcomes** are used to describe the qualification and it is important that the units of learning outcomes are designed so that they can be:

- **Clearly understood** by involved actors - such as learners, teachers and trainers in home and host institutions, and competent institutions with responsibility for validating and recognising learning outcomes achieved during geographical mobility.
- **Achieved during mobility** - for example, taking into account learners’ existing knowledge, skills and competence, the duration of the planned mobility and the learning opportunities able to be accessed in the host institution and country.
- **Assessed abroad** - for example, taking into account learners’ foreign language skills - some learning outcomes may be easier to assess abroad than others.
- **Recognised** when the learner returns to the home institution.

5.2 Component 2 – Organic Agriculture

This Component provides knowledge on the basic principles of organic production system, the difference between organic and conventional products, technologies in organic production, breeding technology of organic livestock production, disease control, pests and weeds in organic farming, etc. (Angelova, Popov, Ivanova, 2008). The course of study includes the following topics:

- History of Organic Farming
- Principles of Organic Farming
- Basics about Soil and Agriculture

- Soil and Agriculture II
- Soil and Humus Management
- Humus Management
- Basics of Organic Crop Farming
- Crop Rotation
- Plant Protection and Weed Regulation
- Plant Protection
- Animal Welfare

5.3 Component 3 - The Retailer of Organic Products and its 5 Professional Profiles

The first point the partners agreed on is the overall Professional Qualification which is the ultimate goal of the learning paths we have been working around. On the basis of previous projects' results and surveys, we believe that today in Europe a new Professional Qualification is stemming from the onward and upward growth of organic products market, the RETAILER OF ORGANIC PRODUCTS. It was precisely this Professional Qualification the aim of Eco-Qualify previous Leonardo da Vinci project, we capitalized inside the current project. A long and deepened discussion lets partners to In the field of Organic Food Retailing the partners of ECVET-EcoQualify project have been determined 5 Professional Profiles which represent the progressive professional development of initially non-skilled people should follow to attain the higher level of Knowledge, Skills and Competences that could make them as a professional Organic Shop Manager. This point is a very meaningful one, as it clearly shows that Organic Retail Sector is a new employment area where it is possible to build up a satisfactory, dynamic and motivating career, not yet taken into consideration by traditional education institutions like high school and universities. In the following Table 1, we present the general description, based on EQF criteria, of the five Professional Profiles building up the Professional Qualification of RETAILER OF ORGANIC PRODUCTS, namely:

1. General Agro-food Shop Beginner;
2. Organic Products Shop Junior Sales Assistant;
3. Organic Products Shop Sales Assistant;
4. Organic Products Shop Area Manager;
5. Organic Products Shop General Manager.

5 Conclusion

The e-learning course designed on the project ECVET-EcoQualify provides the opportunity to implement for the first time in Bulgaria the e-learning approach in the field of organic food retailing. The target group of teachers and trainers will gain sufficient knowledge, skills and competence in the field of organic agriculture, organic food marketing, etc.

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Specialization And Concentration Of Agricultural Production In The Region Of Central Macedonia (Greece)

Athanasios Ragkos[1], Vagis Samathrakis[2], Alexandros Theodoridis[3], Ourania Notta[4], Christos Batzios[5] and Elias Tsourapas[6]

[1]Department of Agricultural Technology, Alexander Technology Educational Institute of Thessaloniki, Greece, e-mail: ragkosagrecon@gmail.com
[2]Department of Accounting & Finance, Alexander Technology Educational Institute of Thessaloniki, Greece, e-mail: sbagis@acc.teithe.gr
[3]School of Veterinary Medicine, Aristotle University of Thessaloniki, Greece, e-mail: alextheod@vet.auth.gr
[4]Department of Agricultural Technology, Alexander Technology Educational Institute of Thessaloniki, Greece, e-mail: ournotta@farm.teithe.gr
[5]School of Veterinary Medicine, Aristotle University of Thessaloniki, Greece, e-mail: batzios@vet.auth.gr
[6]School of Science & Technology, Hellenic Open University, Greece, e-mail: elts2310@yahoo.gr

Abstract. The purpose of this study is to examine the concentration and specialization trends of crop and livestock production in the Region of Central Macedonia, Greece, during the 1980-2006 period. The Region of Central Macedonia is ranked second in terms of GDP and population among the 13 Greek Regions and the total value of its primary production is the highest in the country. The analysis indicates low specialization coefficients for most of the Prefectures in the Region, and high concentration coefficients for crops of particular economic and social importance for small areas of some Prefectures, such as olives and tree crops. Traditional livestock sectors such as cow, sheep and goat farming are widespread in the Region, while, recently introduced activities, such as pork and poultry production, exhibit considerably high concentration coefficients. These findings can be of interest in the design of appropriate management strategies either for market-oriented or formerly highly protected sectors.

Keywords: Concentration indexes, Specialization coefficients, Concentration coefficients, Land use, Agricultural policy

1 Introduction

Recent developments in Greek economy have highlighted the necessity of competitive economic activities, which will contribute to the improvement of basic economic indicators and will reverse negative trends of employment. European Union (EU) policies have affected the performance of all sectors of the Greek

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economy in multiple ways during the past three decades. Amongst them, the Common Agricultural Policy (CAP) and its consequences on the Greek agricultural sector since the country's adhesion in 1981 constitute the most illustrative examples. Protectionism in the sector brought about considerable improvements in farm incomes which, combined with structural interventions and rural development policies, contributed highly to the development of Greek rural areas. Nevertheless, the vast expansion of heavily subsidized farming and livestock production activities rendered the Greek agricultural sector sensitive to the CAP reforms, especially after 1992. As a result, trade constraints altered the Greek trade balance and the farming sector and isolated agricultural production from market demands, which, consequently, affected the Greek economy as a whole.

The agricultural sector in Greece, despite its diminishing contribution in GDP and employment, maintains a relatively high role in the Greek economy. Crop and livestock production support manufacturing and the multiplicative effects of relevant investments boost rural economy. At the local or the regional level, agriculture supports rural family incomes and employment and reverses depopulation and marginalization of remote, mountainous and less-favored areas. This rough presentation of the Greek farming sector illustrates its potential for supporting activities which would assist the recovery of the national economy.

Under the light of the new CAP reform in 2013 (European Commission, 2013), a further liberalization of agricultural markets is expected to cause additional problems in the sector's performance and to affect its multifunctional character, creating simultaneously new opportunities. After a long period of protectionism, the operation of a liberalized agricultural sector in the context of financial stress constitutes a major challenge for Greek policy-makers, which could provide considerable development opportunities, if appropriate strategies were developed. A late or poor response to these conditions, on the other hand, would deteriorate existing deficiencies and would pose additional pressures on the fragile Greek economic system. Furthermore, growing public awareness concerning environmental protection points to a shift towards environmental-friendly activities and farming practices, which would mitigate pressures on ecosystems and would contribute to the maintenance of biodiversity and water resources (European Commission, 2000).

Within this context, the structure of agricultural production and its temporal and spatial evolution can provide valuable information concerning the prospects of the sector. Such an examination will reveal activities of major importance, in terms of their expansion at the regional or the national level, and small-scale activities at local level, which take advantage of local particularities and comparative advantages and play a vital role in local economies. Furthermore, it permits the examination of the degree to which agricultural production is diversified at a certain geographical level (local, regional and/or national). Apparently, this approach becomes highly relevant to the design of development projects and farm policies, while it can also inform environmental policies, by recognizing linkages between cropping and husbandry systems and environmental quality.

The issues of changes in cropping patterns and of the restructuring of crop and livestock production have been examined by numerous authors. The main methodological approaches include mathematical programming models and Multiple Criteria Analysis (Dooley et al., 2009; Manos et al., 2010; Zerger et al., 2011). These

papers focus on the achievement of goals through the maximization of an objective function, but do not examine the factors that lead to the formulation of particular cropping patterns and activities. However, the use of concentration indexes regarding the description of the Greek agricultural sector has been limited (Samathrakis, 1997; Samathrakis, 1998, Samathrakis, 1999). These studies discuss the effects of the CAP on the structure of farming and livestock production activities until 1996, but do not consider environmental protection policies as well as the impact of the CAP reforms in 2000 and 2006. Singh and Dhillon (2004) and Leeuwen et al. (2010) examine concentration and specialization, without providing interpretations of the trends they record.

The purpose of this study is to examine the concentration of crop and livestock production as well as the degree of specialization in crop agricultural and livestock sectors of the Region of Central Macedonia in Greece. The choice of this particular Region is justified in terms of its importance in crop and livestock production at the national level and on its high contribution to the Greek agricultural economy. The methodological framework includes the calculation of concentration indexes for particular sectors at the Prefectural level and of concentration and specialization coefficients (Vate, 1983) for sectors at the regional level and for each Prefecture respectively. The analysis is based on official data from the Greek Statistical Authority concerning the value of agricultural production for certain years of the 1982-2006 period, in order to account for changes induced by the implementation of the CAP.

2 The Region of Central Macedonia

The Region of Central Macedonia (RCM) includes seven (7) Prefectures (Imathia, Thessaloniki, Kilkis, Pella, Pieria, Serres, Chalkidiki) and it is the most developed among Greek northern Regions, which is due to rich endowments to natural and human resources, its strategic geographical position, urban development (mainly the city of Thessaloniki, which is the second most populated city in Greece) and the dynamic structure of production activities. The primary sector of RCM stood for 22.6% of the total value of primary production in Greece, which is the highest among 13 Regions (Hellenic Statistical Authority, 2014a). According to the Regional Accounts of the Hellenic Statistical Authority (2014b) sectoral contribution to the Gross Value Added in RCM for the 2011 was 7.7%, 14.8% και 77.5% for the primary, secondary and tertiary sectors respectively. Furthermore, about 16.7% of the labor force in RCM was employed in agriculture in 2011 (Hellenic Statistical Authority, 2014c).

This rough presentation of RCM illustrates the particular role of the agricultural sector in Regional economy. The development of the agricultural sector in RCM is linked to the efficient use of existing natural resources and to transportation, marketing and processing infrastructures. According to the Agriculture and Livestock Census in 2009 there were 136,378 crop farms, of average size 4.71ha, operating in RCM. Irrigated land accounts for 49.2% of total agricultural land, which constitutes a significant advantage for RCM's farming sector. The prevailing farming types were

formulated under the influence of the CAP, which favored the expansion of cereal and tobacco in non-irrigated areas and of cotton, sugar beet and maize in irrigated areas. Tree crops and vineyards are also important for the Region. The livestock breeding sector is of major importance for RCM; dairy farming is the most important, but several other activities (sheep –goat, poultry and pork farming) can be found in most areas. It should be noticed that agriculture and livestock breeding constitute a major (or the only) sources of income and employment for numerous mountainous and less-favored areas in RCM.

3 Methodological framework

Concentration indexes constitute one of the numerous methodological tools for the examination of regional economies. These indexes provide an interpretation of the relative importance of a product, in terms of concentration, among geographic units. In spite of their computational simplicity, these indexes cannot fully account for the degree of specialization of a region in a particular product or the degree of specialization of a Prefecture, which would enable comparisons among Regions, Prefectures and products (Samathrakis, 1997).

The drawbacks of the aforementioned indexes are mitigated with the introduction of concentration and specialization coefficients. These coefficients constitute an obvious separation criterion of Prefectures for each product under consideration or, symmetrically, a separation criterion of products in respect to each Prefecture, regardless the nature of the products. Specifically, the discrimination of Prefectures or products on the basis of the value of the concentration index (smaller or larger than 1) is typically similar to the segmentation technique of Belson (Hugues et al., 1970).

These coefficients can be applied in two cases (Samathrakis, 1997). The concentration coefficient is a synthetic measure which permits a distinction among Prefectures, revealing the degree to which a product is concentrated at the regional level. The specialization coefficient, on the other hand, constitutes a synthetic criterion of separation of the products under consideration and reflects the degree to which a Prefecture is specialized in certain products.

The calculation methodology of specialization coefficients includes five steps (Samathrakis, 1997).

A. Construction of the concentration index matrix, following Formula (1).

$$PCI_{ij} = [GVP_{ij} / TGVP_j] / [RGVP_i / TRGVP] \quad \textbf{(1)}$$

where

PCI_{ij}: the Concentration Index for j=1,2,…n Prefectures and i=1,2,…m products,

GVP_{ij}: the Gross Value of agricultural Production of each product in each Prefecture,

$TGVP_j$: the Total Gross Value of agricultural Production in each Prefecture,

$RGVP_i$: the Gross Value of Production of each product in the Region and

TRGVP: the Total Gross Value of agricultural Production η in the Region.

This index reflects the specialization of each Prefecture in certain activities and allows for comparisons between each Prefecture and the Region. The index equals zero (0) if the product under consideration is not produced in a Prefecture, while there is not a specific maximum value. If the index exceeds 1, the product is relatively more frequent in a particular Prefecture than in the Region and, consequently, the Prefecture has relative position more important to the specific product than to other products .

If the value of the ratio is greater than 1, this means that this product is relatively more frequent in this county than in the Region and same time that this State has relative position more important to the specific product than for other products.

B. Construction of the derived specialization index matrix for each product, by focusing on "Core Prefectures", that is the Prefectures for which the concentration index value exceeds 100 for a particular product.

C. Calculation of deviations between "actual" and "theoretical" values of the derived matrix (E_i) for each product. "Theoretical" values correspond to those obtained if the relative percentage of a product in "Core Prefectures" was equal to the corresponding percentage for all products. The separation of Prefectures based on values of the concentration index that exceed 100 defines a classification for which the deviation is maximized. This attribute forms the basis for the segmentation criterion.

D. Calculation of maximum deviations (E^*_i) for each product. For any given regional distribution of the product under consideration the index E_i reaches a maximum (denoted E^*_i). This maximum is linked to the concept of "ideal partition", which would enable to forecast the concentration of a product with zero error probability.

E. Calculation of the concentration coefficient (S_i) for each product (E_i/E^*_i). The coefficient obtains values within the {0,1} interval and permits comparisons of concentration indexes for each product in the Region. Hence, the production of X is more concentrated than the production of Y if $S_X > S_Y$.

By means of the same methodological steps, but reversing products and Prefectures, one may obtain specialization coefficients for a Prefecture (S_j). Prefecture A is, then, more specialized than Prefecture B if $S_A > S_B$.

Data for the calculation of specialization and concentration coefficients include the Gross Value of production for most crops and livestock sectors in all seven Prefectures of the Region of Central Macedonia. The analysis focuses on years 1982, 1986, 1991, 1996, 2003 and 2006, which cover for the whole period from the adhesion of Greece in the EEC (1981) to the implementation of the most recent CAP reform (Regulation (EC) 1782/2003, European Commission, 2003).

4 Results of the analysis

The concentration coefficients for the main products in RCM for the 1982-2006 period are presented in Table 1.

Table 1. Concentration coefficients of the main agricultural and livestock products in the Region of Central Macedonia (1982 – 2006)

PRODUCTS	Years					
	1982	1986	1991	1996	2003	2006
Cereal	0.31	0.25	0.24	0.28	0.14	0.17
Durum wheat	0.53	0.37	0.60	0.33	0.46	0.29
Maize	0.28	0.26	0.25	0.13	0.28	0.27
Rice	0.81	0.57	0.56	0.58	0.52	0.51
Industrial and aromatic plants	0.24	0.20	0.23	0.35	0.32	0.36
Cotton	0.32	0.23	0.12	0.30	0.24	0.38
Sugar Beet	0.34	0.36	0.40	0.45	0.32	0.34
Tobacco	0.29	0.35	0.30	0.38	0.43	0.42
Sunflower	0.51	0.48	0.57	0.76	0.59	0.62
Vegetables	0.15	0.21	0.21	0.18	0.17	0.12
Potatoes	0.25	0.24	0.36	0.48	0.28	0.35
Industrial tomato	0.26	0.24	0.29	0.26	0.16	0.17
Edible legumes	0.22	0.33	0.47	0.60	0.68	0.35
Legumes for fodder	0.29	0.54	0.61	0.78	0.43	0.35
Fodder crops	0.21	0.29	0.20	0.26	0.24	0.25
Olive oil	0.79	0.62	0.81	0.63	0.59	0.59
Wine	0.39	0.28	0.37	0.35	0.18	0.25
Fruit	0.65	0.64	0.65	0.68	0.61	0.54
Apples	0.61	0.55	0.50	0.61	0.60	0.55
Apricots	0.73	0.65	0.87	0.63	0.66	0.52
Peaches	0.66	0.69	0.71	0.69	0.65	0.59
Cherries	0.50	0.58	0.47	0.64	0.57	0.55
Nuts	0.34	0.30	0.30	0.34	0.45	0.43
Beef cattle meat	0.17	0.15	0.20	0.27	0.30	0.30
Lamb meat	0.08	0.12	0.11	0.12	0.18	0.19
Goat meat	0.14	0.18	0.18	0.18	0.26	0.25
Pork meat	0.12	0.21	0.22	0.35	0.46	0.43
Poultry meat	0.21	0.38	0.29	0.25	0.31	0.49
Cow milk	0.23	0.27	0.28	0.43	0.44	0.48
Sheep milk	0.14	0.16	0.12	0.16	0.13	0.19
Goat milk	0.19	0.18	0.20	0.20	0.22	0.20
Eggs	0.14	0.38	0.26	0.34	0.39	0.35

The results do not indicate high concentration trends for arable crops in RCM, which are found in almost all areas of the Region. Concentration indexes for each Prefecture are reported in the Appendix.

4.1 Concentration of agricultural production in the Region of Central Macedonia

4.1.1 Crop Production

Cereal are the main crops in non-irrigated, mountainous and less-favored areas. Durum wheat is cultivated by most farms in these areas, mainly because of heavy subsidization, especially from 1981 to 2006, as the quality premium substantially increased prices. The corresponding concentration coefficient varies between years, depending on international prices and weather conditions, which affect yields. Durum wheat is suitable for marginal land and is characterized by low input requirements, which results in a rather positive environmental impact.

Rice production in the Region is highly concentrated, as the concentration coefficient varies from 0.51-0.81. The two centers of rice production in Central Macedonia are in Thessaloniki and Serres, where its economic and environmental role is vital, as it develops sloping and low-quality land, which is inappropriate for other crops.

Cotton is a predominant crop in Greece and of particular importance for RCM. It extends in irrigated areas of almost all Prefectures and exhibits high concentration indexes in the Prefectures of Serres, Pella (especially in Giannitsa plain) and Imathia (especially during the early years of implementation of CAP in Greece). The subsidy system, based on acreage, substantially improved farm incomes in the Region; however, the high concentration of cotton crops in protected areas with environmental problems (Lake Kerkini in Serres, Axios Delta in Thessaloniki) resulted in extended pollution of water reserves, due to intensive use of agrochemical inputs (nitrogen, herbicides, insecticides) (Ragkos and Psychoudakis, 2009).

Sugar beet constitutes a crop of major economic importance for Greek agriculture. Its production is based on contract farming, supervised by the Hellenic Sugar Industry (HSI). The HSI is responsible for the implementation of the EU policy in the sugar sector and also for sugar beet procession and the production of sugar. Central Macedonia is one of the main Regions in sugar production. The concentration coefficient of the crop in the Region is relatively high, which implies the existence of sugar beet production cells, developed around the sugar processing factories in RCM. During the years under consideration, one observes a declining concentration index for sugar beet in Pella, with a corresponding increase in the concentration index in Serres, which is due to developments in the operation of the sugar factories in the two Prefectures.

Tobacco constitutes a heavily subsidized crop which boosted farm incomes, contributed to the reversion of depopulation trends in rural areas and affected their social structures. The subsidy system induced the expansion of foreign irrigated varieties (Virginia, Burley) at the expense of domestic quality varieties (Basmas),

which, nonetheless, had competitive advantages in markets, formulating tobacco production cells in the Prefectures of Pieria, Serres (particularly in Nigrita and Visaltia) and Pella. Concentration coefficients for tobacco increase from 1982 to 2006, when subsidies were decoupled from production.

Sunflower constitutes an alternative crop to tobacco and winter cereal, in order to develop non-irrigated areas of the Region under the light of CAP reforms. Its perspective in the production of biofuel results in a considerably high concentration coefficient, which implies its major importance for certain areas in the Region. During the first years of the period under examination the main production centers of sunflowers were met in Pella, Kilkis and Thessaloniki; recently (2003 and thereafter) the relevant concentration index is very high for the Prefecture of Imathia.

The concentration coefficient for vegetables is low during the 1982-2006 period, as their production is scattered in numerous areas of all the Prefectures. Protectionism in the vegetable sector has been relatively low, compared to other crops, hence vegetable crops stand for a small percentage of the total irrigated area. Nevertheless, they constitute the basic perspective for the farming sector of RCM, as they adapt well to soil and climate conditions, they develop its comparative advantages and are predominantly market-oriented. Opportunities of the sector are linked to the improvement of transportation, marketing and processing infrastructure, which would induce the creation of production cells in specific areas, increasing the concentration coefficient. Industrial tomato in the Prefecture of Serres is an illustrative example, as the concentration index was relatively high until 2003, while tomato processing units were operating in the Prefecture, and was considerably reduced thereafter.

Edible legumes exhibit high concentration coefficients during the period after 1991 (0.35-0.68), due their concentration in areas of Serres and Pieria. Crops of this category are typical examples of locally important crops, which use excessive farm family labor and are oriented to market demand.

Olive oil, although a typical Mediterranean Greek product, is of relatively low importance to RCM. The high concentration coefficient of this product (0.59-0.81) is interpreted in conjunction to its high concentration index for Chalkidiki. Olive oil is important for the rural economy of the Prefecture, as it constitutes a supplementary source of income for numerous families. The implementation of strategies aiming at the enhancement of quality and marketing conditions could improve its potential for RCM.

The concentration of wine production follows a decreasing pattern. The concentration index for wine, which reaches a minimum at 2003 (0.18), depicts the results of the CAP, as the restrictions introduced in 2000 brought about a significant decrease in the number and acreage of vineyards. Wine production, on the other hand, provides many areas of RCM with development opportunities, linked to the production of quality wines. The concentration coefficient is particularly low for 2003 and 2006, due to the emergence of such areas in all Prefectures, through wine tourism initiatives (e.g. “Wine Routes”).

Tree crops exhibit a high concentration coefficient (0.54-0.68), although declining during recent years. This is due to the intensive production of fruit, mainly in the Prefectures of Imathia and Pella. The predominance of tree crops in these Prefecture is due to favorable climate and soil conditions as well as to heavy

protectionism in the sector, mainly until 1992. These activities are vital to the economy of both Prefectures, as they provide income and employment to many farm families and they support considerable investments in processing and transportation.

Nuts are treated as a separate category within the analysis. Their high concentration coefficients are explained through their high concentration index in the Prefectures of Pieria, Kilkis and Chalkidiki, where they play an important role at the local level.

4.1.2 Livestock production

The dynamics of the livestock production sector in RCM are illustrated through the concentration indexes and coefficients for livestock products (Table 1). The production of cow milk exhibits an increasing concentration trend in the period under examination. During the first years, heavy protectionism resulted in the appearance of dairy farms in almost all areas of RCM. From 1991 and thereafter, increasing concentration coefficients (from 0.28 to 0.48) reflect the consequences of the quota regime. Production rights were gathered to fewer producers and large-scale dairy farms were formulated in some areas, mainly in the Prefecture of Thessaloniki. These farms undertook substantial investments in fixed capital and animal resources and pursued the amelioration of productivity.

Beef production is mainly concentrated in the Prefecture of Kilkis. However, the rearing of small, indigenous buffalos constitutes a typical activity for Kerkini area in the Prefecture of Serres. The economic performance of this production system is more than satisfactory, while it also contributes to the protection of indigenous genetic resources and biodiversity.

Pork production is mainly concentrated in the Prefecture of Pieria and in some areas of Imathia and Kilkis, which exhibit the highest indexes. Its importance for these regions is linked to the achievement of economies of scale by pork farms, which exhibit highly entrepreneurial characteristics. Poultry production also constitutes an intensive entrepreneurial activity, which cannot be undertaken by family farms typically operating in RCM. Considerable investments in the sector in the Prefecture of Thessaloniki result in a high concentration coefficient for RCM, mostly in recent years.

Sheep and goat farming is a typical activity for mountainous, less-favored and remote Greek areas. In RCM, the production of sheep and goat milk follows the same pattern; concentration coefficients are low during the whole 1982-2006 period, due to the existence of such areas in the whole acreage of RCM. The sector is of vital economic and social importance for these areas, because it uses land with no alternative uses for pastures and provides employment and income to farm families, where the rural economy is not diversified and alternative activities are not readily available. Meat production is even less concentrated, but a slightly increasing trend is observed for recent years, due to the operation of new processing centers in various areas. The substantial reduction of the concentration index for goat meat in Chalkidiki is counterbalanced by an increase in Pieria, which is indicative of the aforementioned developments.

It is worth to notice that concentration indexes for fodder crops and maize do not follow the same pattern with livestock production (not even dairy farming, which is heavily dependent on roughages), contrary to what was expected. Hence, these crops did not evolve in the centers of livestock production in RCM; on the contrary, they are scattered in all irrigated areas of the Region. This spatial organization of fodder production, reflected in the concentration indexes, implies inefficiencies in livestock production, as feeding costs are burdened with transportation costs, and potential market failures occur, given the distance between production cells of livestock products and fodder.

4.2 Specialization trends in the Prefectures of RCM

Table 2 presents the specialization coefficients of the Prefectures of RCM during the period under consideration. Imathia exhibits the highest coefficient among all seven Prefectures, as was expected, due to the predominance of tree crops. The common characteristic of the other six Prefectures is the relatively low specialization coefficient, which does not exceed 0.4 in most cases. This illustrates the structure of the agricultural sector in RCM, characterized by the large number of small family farms, which adopt a relatively large number of crops and livestock breeding activities. The broad range of farming types is typical for Greek Regions and for other Mediterranean countries.

Table 2. Specialization coefficients of the Prefectures of the Region of Central Macedonia (1982 – 2006)

Years	Prefectures						
	Imathia	Thessaloniki	Kilkis	Pella	Pieria	Serres	Chalkidiki
1982	0.451	0.313	0.269	0.258	0.330	0.207	0.354
1986	0.473	0.287	0.327	0.234	0.345	0.260	0.362
1991	0.448	0.279	0.291	0.330	0.364	0.212	0.391
1996	0.355	0.401	0.439	0.336	0.411	0.282	0.536
2003	0.669	0.127	0.358	0.372	0.334	0.256	0.440
2006	0.576	0.296	0.246	0.303	0.568	0.378	0.394

An examination of the specialization coefficients over time reveals increasing specialization trends for four (4) Prefectures in recent years. These trends are due to effects of the CAP, which favored the expansion of a small number of farming activities through the subsidization scheme, combined with the emergence of innovative crops at the local level. The Prefecture of Serres is an example of the former category, where arable crops prevail; nonetheless, these specialization trends do not conform with environmental policies, as the presence of protected areas (lake Kerkini, protected under the Ramsar Convention) calls for the adoption of activities with minimum agrochemical input requirements. In the latter category, the Prefecture of Imathia is further specialized in tree crops, feed crops and pork production, that is, in activities that develop its comparative advantages. In Pella, it is worth to notice the

increasing importance of tree crops and of certain industrial crops. The Prefecture of Pieria specializes in activities that are explicitly market-oriented, including poultry production, vineyards and vegetable production

The specialization coefficients of the remaining three Prefectures of RCM (Thessaloniki, Kilkis and Chalkidiki) remain relatively steady during the period under examination. In Thessaloniki, soil and climate conditions, existing infrastructures and the general economic context favor investments in a relatively broad range of production types. In Kilkis, the low specialization coefficient is due to the diversified livestock breeding sector and to the low percentage of irrigated land (21.1%, Hellenic Statistical Authority, 2005), which only permits a limited range of production activities and discourages the formulation of innovative production centers. Last but not least, the predominance of a relatively small number of traditional farming activities in Chalkidiki results in relatively high specialization coefficients for all years.

An interesting observation stems from the fact that specialization coefficients in 1996 are considerably higher for all Prefectures, except for Imathia. This demonstrates the effects of the 1992 CAP reform, which introduced subsidies per acre or per animal, rather than depending on the produced quantity, and established the milk quota regime. This shift in policy favored the expansion of heavily subsidized sectors, mainly dairy farming, maize and durum wheat, which substituted soft wheat in arid land.

5 Conclusions

The use of concentration and specialization indexes and coefficients constitutes a rather simple approach, aiming at the examination of concentration trends of crop and livestock production at the Regional level, while specialization coefficients permit comparisons among Prefectures. In this study, such indicators are the basis of a critical presentation of the crop and livestock breeding sectors of the Region of Central Macedonia, which aims at an interpretation of the factors that affected their structure. The empirical analysis revealed sectors which are common for all areas in the Region and others, which are typical of particular areas and Prefecture, thus increasing their corresponding concentration indexes.

The calculated indexes and coefficients yield valuable information concerning the prospects of the agricultural and livestock breeding sectors of RCM. The choice of the appropriate development strategy at the Regional and/or the Prefectural level should take into account the spatial distribution of each crop, along with its relative importance to specific areas and to the Region as a whole, in order to boost the efficiency of agriculture and to provide economic development opportunities.

Arable crops predominate in almost all areas, therefore presenting relatively low concentration coefficients. The perspectives of these crops, so far heavily protected by the CAP, are linked to the future of EU policies. Furthermore, low concentration coefficients indicate their geographical spread, therefore strategies concerning their continuation can be designed at the Regional level, as consequences of such strategies would affect producers in a similar way. On the other hand, sectors

exhibiting high concentration coefficients may formulate the axes on which to design targeted strategies in order to resolve endogenous problems of the Greek farming sector. Such activities can be incorporated into quality systems, which take into account comparative advantages and market demands, in order to mitigate the effects of high production costs of Greek farms. Strategies based on quality and alternative marketing approaches are also applicable to heavily subsidized concentrated crops, such as tobacco, given that their substitution in their production centers is difficult to achieve.

The proposed strategies for each product should, nonetheless, take into account the specialization at the Prefecture level and incorporate adjustments in order to accommodate differences. Prefectures with high specialization coefficients are characterized by the predominance of crops with particular contribution to incomes and employment at the local level; in this case, proposed strategies should focus on existing activities, emphasizing on marketing, quality and processing, thereby facilitating their access to markets. On the contrary, low specialization coefficients point out less opportunities for targeted measures for particular activities. This case calls for generalized strategies, aiming at the mitigation of structural deficiencies, the enhancement of basic infrastructure for all activities (for example transportation) and favorable economic conditions to induce investments.

The environmental impact of highly concentrated activities should also constitutes an important element in policy design. The presence of concentrated production centers in environmentally sensitive areas calls for the introduction of special initiatives, in accordance with the environmental policy in force (Dir. (EC) 60/2000 and (EC) 43/92). Farm education in environmental issues, agrochemical input control and the introduction of alternative farming practices (integrated crop management and organic farming) constitute examples of potential relevant actions. Environmental awareness is nowadays well-established in the design and implementation of agricultural policy measures. The methodological framework presented in this paper provides additional possibilities of further incorporation of environmental issues in decision-making.

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Appendix 1. Concentration indexes for each Prefecture in RCM (1982 - 2006)

PRODUCTS	THESSALONIKI						CHALKIDIKI					
	1982	**1986**	**1991**	**1996**	**2003**	**2006**	**1982**	**1986**	**1991**	**1996**	**2003**	**2006**
Cereals	143.8	125.1	117.6	202.0	131.5	128.9	145.6	129.5	93.0	38.5	92.2	70.7
Durum wheat	189.5	108.9	49.2	168.2	154.2	126.5	426.4	279.1	739.9	0.0	293.8	214.7
Maize	121.8	78.6	91.4	100.5	51.9	65.1	5.7	10.3	14.8	28.0	8.3	10.1
Rice	499.6	333.3	268.4	140.5	204.3	204.3	0.0	0.0	0.0	0.0	0.0	0.0
Edible legumes	67.3	40.6	21.5	7.2	42.3	75.8	118.2	86.2	4.0	19.6	34.9	250.3
Industrial and aromatic plants	58.5	62.8	72.8	47.0	59.1	25.5	16.2	32.5	26.1	21.4	38.3	20.4
Tobacco	50.8	37.9	53.6	36.8	45.9	67.9	14.3	11.1	16.1	4.1	4.3	8.9
Cotton	98.5	119.1	122.7	64.5	72.8	3.9	22.8	67.9	48.6	46.0	22.3	21.6
Sugar beet	33.5	14.2	26.1	22.3	41.3	39.5	0.0	0.0	0.0	0.0	0.0	0.0
Sunflower	0.0	82.9	363.5	449.1	103.4	87.9	0.0	137.8	32.7	15.9	1.5	1.2
Vegetables	159.0	158.3	130.7	133.0	89.3	115.5	121.2	146.2	83.9	156.5	293.4	196.1
Potatoes	63.6	72.5	36.7	68.6	37.3	66.3	31.3	103.9	129.0	122.3	114.3	51.5
Industrial tomato	77.6	92.4	84.5	100.5	107.4	136.9	0.0	0.0	0.0	0.0	49.7	229.6
Legumes for fodder	119.9	118.1	0.6	459.9	33.0	114.1	113.9	364.9	1.2	0.0	14.4	13.0
Fodder crops	105.6	84.3	127.2	169.5	175.1	154.6	47.6	51.1	117.4	34.2	13.1	58.4
Wine	19.2	93.4	139.6	132.7	108.2	88.9	77.8	208.9	231.7	187.8	194.0	295.4
Olive oil	10.4	64.5	25.4	49.2	30.5	47.9	1219.2	992.0	1165.6	1100.7	652.9	851.9
Fruit	7.1	8.3	7.2	5.1	8.4	9.8	32.1	27.4	37.1	24.3	41.5	58.7
Nuts	56.1	78.9	45.6	56.7	18.9	22.3	126.3	135.9	197.1	162.1	357.6	218.6
Beef cattle meat	77.5	115.3	111.3	140.5	126.1	101.5	38.1	36.8	26.6	24.6	26.2	29.3
Lamb meat	111.4	94.0	95.6	111.7	129.7	148.2	68.0	47.8	68.4	59.5	64.4	69.7
Goat meat	111.9	83.1	95.5	113.9	121.7	131.2	249.7	268.2	259.8	247.3	119.2	114.1
Pork meat	98.8	121.8	82.3	51.9	45.3	35.2	133.8	98.8	76.7	78.6	79.5	92.2
Poultry meat	196.4	277.4	190.9	165.8	186.8	173.8	78.3	54.9	31.8	78.2	92.6	73.4
Cow milk	176.0	170.3	187.4	206.8	264.3	322.4	27.2	19.1	21.9	18.7	1.6	1.6
Sheep milk	101.7	118.5	113.8	106.4	117.8	142.6	65.1	59.2	68.0	71.3	73.8	78.1
Goat milk	82.4	116.7	111.0	99.9	82.2	100.1	306.5	247.8	234.8	218.8	275.4	284.1
Eggs	164.8	276.1	210.4	253.7	278.6	254.4	92.4	79.0	64.4	56.8	32.7	90.2

PRODUCTS	PIERIA						IMATHIA					
	1982	**1986**	**1991**	**1996**	**2003**	**2006**	**1982**	**1986**	**1991**	**1996**	**2003**	**2006**
Cereals	24.6	61.8	70.1	68.7	79.1	64.6	32.9	39.2	53.3	81.0	110.0	110.4
Durum wheat	5.0	33.8	32.5	95.2	68.5	105.7	1.5	15.2	11.9	27.9	21.0	13.5
Maize	60.1	59.8	52.0	95.8	82.3	45.5	68.5	90.1	119.6	146.2	73.1	79.2
Rice	0.0	0.0	28.3	9.0	69.1	40.1	0.0	6.7	0.9	372.3	273.0	266.6
Edible legumes	255.8	418.8	592.0	369.6	945.9	324.5	49.3	53.2	4.9	43.2	10.5	12.4
Industrial and aromatic plants	221.7	190.6	245.7	220.3	80.8	51.4	134.0	103.4	62.9	70.5	82.3	102.0
Tobacco	287.4	299.3	369.5	399.3	117.6	46.2	58.0	36.9	33.8	44.9	18.8	5.3
Cotton	59.2	44.6	53.0	34.5	60.3	54.9	306.9	205.0	90.2	91.8	116.6	133.1
Sugar beet	165.2	112.2	121.3	55.1	63.3	47.2	239.7	200.7	156.2	151.5	127.0	117.4
Sunflower	0.0	3.3	0.1	0.5	33.4	38.5	253.5	4.8	2.7	0.0	455.7	439.7

Vegetables	73.6	70.9	41.5	50.2	107.2	101.8	53.4	65.4	49.1	56.5	98.6	90.6
Potatoes	65.3	38.0	30.9	16.6	16.8	28.3	30.0	19.5	2.0	13.2	51.9	22.4
Industrial tomato	4.7	45.8	49.8	41.4	56.0	41.4	100.1	202.9	38.4	76.5	129.2	62.2
Legumes for fodder	199.0	0.0	0.0	0.0	6.2	0.0	0.0	0.0	0.0	0.0	198.9	207.5
Fodder crops	75.8	58.2	59.6	79.3	107.4	132.5	38.0	24.0	43.2	71.3	53.7	53.6
Wine	128.8	33.2	10.0	11.2	189.3	135.7	359.0	238.7	230.5	194.0	112.2	131.2
Olive oil	41.0	67.2	44.9	58.4	299.6	56.9	0.0	9.2	0.0	0.8	0.4	5.3
Fruit	48.4	57.0	47.9	34.4	67.9	99.4	337.9	331.8	334.2	259.2	243.3	236.2
Nuts	401.1	248.1	231.0	127.3	276.7	137.5	34.6	36.8	62.8	36.9	19.1	13.8
Beef cattle meat	45.4	15.0	22.3	10.8	19.2	18.4	131.5	110.4	167.0	135.8	86.8	67.1
Lamb meat	138.6	106.9	114.0	78.4	124.9	103.5	65.9	56.8	77.1	73.0	15.7	10.8
Goat meat	107.7	156.3	91.6	128.4	201.5	164.8	51.5	39.3	39.5	39.8	10.4	9.6
Pork meat	182.2	236.6	209.4	177.4	193.5	199.0	104.8	112.8	176.3	152.5	258.9	225.7
Poultry meat	100.9	58.7	140.6	168.2	241.6	428.5	17.5	18.0	23.4	26.3	10.0	7.0
Cow milk	60.2	24.0	32.2	13.8	25.9	17.6	52.5	42.2	47.2	27.2	25.7	16.5
Sheep milk	149.8	93.8	114.7	77.5	97.8	73.6	57.1	48.7	56.9	48.4	75.3	69.4
Goat milk	158.2	129.5	150.5	152.6	171.4	130.1	46.7	40.6	39.4	51.4	56.2	54.7
Eggs	78.7	60.5	67.7	46.9	104.6	164.0	70.5	57.2	66.4	55.2	25.7	22.7

PRODUCTS	**KILKIS**						**SERRES**					
	1982	**1986**	**1991**	**1996**	**2003**	**2006**	**1982**	**1986**	**1991**	**1996**	**2003**	**2006**
Cereals	156.1	133.1	175.6	120.3	112.5	92.6	128.1	148.5	141.2	105.2	112.6	141.9
Durum wheat	198.3	182.2	134.3	334.6	272.5	213.2	13.3	164.9	64.1	102.0	20.0	108.6
Maize	9.9	21.2	38.1	92.4	76.1	73.2	200.4	221.1	202.5	126.6	242.7	236.9
Rice	0.0	0.0	0.0	0.0	0.0	0.0	0.0	133.7	188.3	41.2	32.5	58.2
Edible legumes	26.1	44.1	2.9	9.8	16.6	17.9	127.3	65.5	103.7	264.7	30.1	94.8
Industrial and aromatic plants	53.1	72.7	85.5	43.4	31.0	41.2	103.5	121.7	128.0	173.2	213.1	224.2
Tobacco	63.7	78.8	100.4	30.0	26.1	54.0	115.9	140.0	115.2	104.9	271.8	245.8
Cotton	24.9	22.7	74.6	6.9	37.5	41.2	39.4	69.0	112.5	246.2	179.9	215.7
Sugar beet	46.2	56.4	38.9	16.2	21.3	15.6	139.7	197.7	242.3	292.5	230.2	258.4
Sunflower	207.3	567.2	0.0	5.7	5.3	3.5	27.6	27.1	86.9	4.9	0.2	0.3
Vegetables	75.8	55.5	57.2	55.0	49.4	42.2	96.5	69.0	98.0	117.4	78.7	88.8
Potatoes	137.0	123.6	81.8	204.9	160.3	72.1	167.3	173.5	263.2	306.8	165.1	233.7
Industrial tomato	45.1	0.0	81.8	79.9	73.8	92.3	190.6	122.6	239.4	237.8	151.2	87.7
Legumes for fodder	0.0	0.0	0.0	0.0	351.8	32.2	170.9	0.0	179.8	0.0	20.5	41.3
Fodder crops	126.2	236.0	121.5	100.4	69.5	130.2	171.0	172.1	147.5	153.8	133.6	139.5
Wine	104.4	71.4	73.1	201.7	86.5	90.3	7.8	54.0	53.7	52.4	82.6	51.1
Olive oil	0.0	0.0	0.0	4.0	4.5	7.8	40.5	51.1	17.0	78.3	103.6	97.3
Fruit	10.7	8.6	7.8	2.6	9.7	4.1	6.3	6.5	11.7	5.8	2.7	7.0
Nuts	168.2	88.0	127.4	214.1	203.6	135.5	85.6	159.1	139.5	200.3	92.6	242.2
Beef cattle meat	170.6	191.1	168.9	245.1	307.1	366.3	117.9	99.5	102.9	72.7	83.9	100.1
Lamb meat	113.7	172.4	169.6	203.5	87.6	100.1	97.4	122.2	116.3	110.1	149.6	140.6
Goat meat	79.3	96.0	168.2	106.0	64.6	83.2	103.2	102.6	91.5	109.4	162.5	164.5
Pork meat	88.8	101.9	59.2	338.6	205.7	184.2	54.8	52.7	107.5	53.7	10.0	10.2
Poultry meat	71.5	34.3	36.4	52.8	80.2	26.8	106.9	81.3	124.2	116.8	63.5	44.9

Cow milk	151.3	195.5	184.8	343.0	160.8	143.0	105.3	111.1	101.5	77.2	26.6	26.2
Sheep milk	165.9	219.0	178.7	284.8	182.5	201.6	78.6	92.3	100.6	85.7	73.3	65.3
Goat milk	99.4	107.8	131.3	198.0	120.3	121.6	69.8	87.8	76.3	64.1	49.8	47.7
Eggs	110.9	101.7	115.3	45.1	54.0	92.2	88.8	7.6	92.4	89.3	79.7	67.6

PRODUCTS	**PELLA**					
	1982	**1986**	**1991**	**1996**	**2003**	**2006**
Cereals	51.1	56.1	48.0	25.7	44.3	53.0
Durum wheat	40.7	7.0	22.8	30.2	19.8	29.4
Maize	84.3	95.7	68.0	63.0	94.1	103.3
Rice	0.0	8.3	0.6	1.4	0.8	0.2
Edible legumes	109.1	106.7	114.9	1.0	18.1	70.8
Industrial and aromatic plants	121.7	107.3	97.1	92.4	123.1	146.2
Tobacco	138.9	115.0	94.3	101.4	136.8	181.3
Cotton	109.1	112.4	122.8	94.1	122.1	142.6
Sugar beet	58.6	64.0	45.0	46.4	115.2	106.1
Sunflower	201.5	64.8	0.1	0.0	0.0	0.0
Vegetables	92.8	116.8	161.4	109.2	80.7	96.3
Potatoes	131.9	135.1	97.9	9.9	147.7	158.1
Industrial tomato	127.1	122.8	83.0	58.5	67.0	95.5
Legumes for fodder	77.7	283.2	345.8	0.0	102.1	175.3
Fodder crops	69.9	66.4	59.2	26.3	68.6	29.7
Wine	96.3	57.6	5.9	14.1	23.8	26.5
Olive oil	0.0	0.4	0.1	0.0	1.0	0.7
Fruit	237.1	229.0	226.1	260.8	275.5	228.6
Nuts	32.1	19.3	32.8	27.9	27.5	24.0
Beef cattle meat	85.0	95.6	64.1	71.4	42.1	50.9
Lamb meat	104.1	93.7	76.1	86.7	101.2	111.7
Goat meat	70.9	72.5	66.4	60.6	57.2	58.8
Pork meat	110.2	40.5	30.5	30.2	16.2	22.8
Poultry meat	73.3	52.9	63.3	57.7	67.3	37.2
Cow milk	61.4	72.0	56.9	48.0	87.4	99.1
Sheep milk	110.0	82.6	83.1	104.0	92.4	87.6
Goat milk	92.1	64.6	65.5	72.1	95.2	88.7
Eggs	70.7	59.3	24.8	38.6	28.2	23.0

Optimizing Soil Moisture Uniformity and Irrigation Management

Ioannis Gravalos[1], Dimitrios Kateris[2], Anastasios Georgiadis[2], Theodoros Gialamas[2], Avgoustinos Avgoustis[2]

[1]Department of Biosystems Engineering, Technological Educational Institute of Thessaly, 41110 Larissa, Greece, e-mail: gravalos@teilar
[2]Department of Biosystems Engineering, Technological Educational Institute of Thessaly, 41110 Larissa, Greece

Abstract. This research is a study on the relationship of irrigation water treatments and soil moisture distribution uniformity (DU). Soil moisture distribution was based on long-term data sets that were collected during wet and dry soil conditions (from permanent wilting point to field capacity) using a novel electromagnetic sensor-based platform moving inside subsurface horizontal access-tubes. The irrigation treatments regarding two case studies under dry and wet soil conditions were conducted for a period of 115 days and 110 days respectively. In dry soil conditions, the irrigation water treatments strongly affect the DU of soil moisture that can be achieved constantly using variable rate irrigation treatments. On the contrary, the DU of soil moisture in wet soil conditions was maintained at a high percentage and was slightly affected by irrigation treatments. However, obtaining accurate soil moisture information at a large scale over a long period can be used to improve water use efficiency.

Keywords: precision irrigation scheduling, sensor-based platform, uniformity.

1 Introduction

The main methods used to describe soil moisture content are gravimetric, volumetric and depth of soil moisture per depth of soil. Many instruments exist for measuring and monitoring soil moisture content and they are summarized as follows: neutron moisture meter, tensiometers, electrical resistance blocs, and dielectric sensors and probes. Dielectric sensors and probes have gained wide acceptance over the last years. This group of sensors and probes determines soil moisture content by measuring the dielectric constant of soil (Muñoz-Carpena, 2004).

Soil moisture content is highly variable in time and space. Soil moisture variations are affected by different factors such as soil texture, topography, crop cover, climate parameters and irrigation practices. Soil moisture variability is very important to understand soil moisture redistribution after rain or irrigation event, infiltration, evapotranspiration and pollutant transport. Various sensing approaches have been developed for measuring spatial and temporal soil moisture variability, including soil

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moisture sensor networks, geophysical methods (Hu et al., 2011) and remote sensing techniques (Moran et al., 2004). A novel horizontal access tubes sensing system for monitoring soil moisture variability using an electromagnetic sensor-based platform was first proposed by Gravalos et al. (2012).

The objective of the study reported here was to investigate the effects of uniform rate irrigation and variable rate irrigation on soil moisture distribution and give recommendations for improved irrigation scheduling and the design of automatic irrigation systems. Soil moisture distribution is based on long-term data sets that were collected during wet and dry conditions (from permanent wilting point to field capacity) using a novel electromagnetic sensor-based platform moving inside subsurface horizontal access-tubes with the task of monitoring the soil moisture distribution.

2 Materials and Methods

Experiments were carried out under laboratory conditions in the Department of Biosystems Engineering at the Technological Educational Institute of Thessaly (Greece) during a period of eight months. In the laboratory room, the ambient temperature was kept nearly constant (≈22 ˚C). For the soil moisture monitoring experiments, an artificial soil tank was used and rigid polyvinylchloride (PVC) plastic access tubes. The soil tank was made of water-resistant wood, having dimensions 1.44 m long, 1.10 m wide, and 0.25 m deep (total volume 0.4 m^3). The three PVC access tubes were placed horizontally, along the soil tank, at a depth of 0.15 m under the soil surface, and at uniform distances. The type of soil used for all series of experiments was clay loam. The total surface of the soil tank was divided using a wood frame into 36 (3 columns x 12 rows) equal cell-rectangles. The wood frame was used for the trapping of applied water in the individual cell-rectangles and thereby ensuring uniform distribution of irrigation water.

A schematic illustration of the prototype electromagnetic sensor-based platform that travels through subsurface access tubes and monitors the soil moisture content is shown in Fig. 1. It was composed of a modified commercial soil moisture sensor (Diviner 2000), which was placed on two articulated wheeled bases. The sensor-based platform is presented in detail elsewhere, see Gravalos et al. (2012). According to Sentek Pty Ltd. (2007), the Diviner 2000 sensor recorded moisture from a soil volume outside the access pipe, which had a sphere of influence of: (a) 100 mm horizontal length, and (b) 50–100 mm radial distance from the outer wall of the access pipe.

The electromagnetic sensor-based platform recorded the soil moisture content at fixed positions of the PVC access tubes spaced out initially at 6 cm and then every 12 cm of length increment (move-stop-measure case). Each position corresponded to the center of each rectangle. Thus, for each access tube a number of 12 measurements have been conducted where every single value is the average value of three readings. By use of a data display unit and a personal computer, the soil moisture content was determined at each position one time per day.

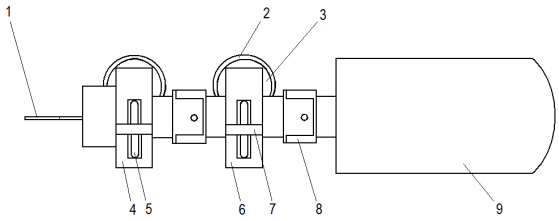

Fig. 1. Schematic illustration of the electromagnetic sensor-based platform. (1) towing hook, (2) driving wheel, (3) DC motor, (4 & 6) wheeled bases, (5) shaft, (7) sliding wheel, (8) universal joint, (9) soil moisture sensor.

In this study, the irrigation water treatments regarding two case studies under dry and wet soil conditions (from permanent wilting point to field capacity) were conducted for a period of 115 days and 110 days respectively. The irrigation water was precisely measured by a volumetric flask and applied directly onto the surface of the 36 equal cell-rectangles of the soil tank allowing high irrigation uniformity. On the first days (2/12/2013 to 19/12/2013) under dry soil conditions, the irrigation water was applied uniformly on the entire tank surface (0.25 l per each cell-rectangle) with an irrigation frequency of 9 liters every 4 days. This way 45 liters of water were initially irrigated. During the next days (20/12/2013 to 30/01/2014), non-uniform irrigation was applied in the soil tank according to the observations provided by the prototype electromagnetic sensor-based platform. In this case, only those cell-rectangles in which the observed soil moisture was lower than $10 m^3 m^{-3}$ were irrigated. The purpose of the variable rate irrigation was to achieve distribution uniformity of soil moisture content in the soil tank around the desired limit of 10 $m^3 m^{-3}$. This period of variable rate irrigation a total of 15.25 liters of water was consumed. The soil moisture content in tank was further increased after a period of one month (01/02/2014 to 28/02/2014) with distribution uniformity of irrigation water in all cell-rectangles (0.125 l per each rectangle). In this treatment the frequency of irrigation was 4.5 liters every 4 days, and was applied in a total 22.5 liters of water. The last time interval (01/03/2014 to 27/03/2014) during the dry soil conditions repeated the variable rate irrigation in the soil tank according to the indications provided by the electromagnetic sensor-based platform. In this case only those cell-rectangles in which the observed soil moisture content was lower than 16 m^3 m^{-3} were irrigated. During this period of variable rate irrigation there was consumed a total of 27.25 liters of water.

The observations regarding wet soil conditions were conducted for a period of 16 weeks (28/3/2014 to 15/7/2014). 36 l of water were applied on the first 4 days (9 l for every irrigation session). The irrigation water was applied uniformly on the surface of each of the 36 equal cell-rectangles of the soil tank. In the next two months (01/04/2014 to 31/05/2014), the irrigation water was applied non-uniformly on the surface of the soil tank according to the observations provided by the prototype electromagnetic sensor platform. The aim of these irrigation treatments was to achieve distribution uniformity of soil moisture content in the soil tank around the field capacity. In this case study only those cell-rectangles in which the observed soil moisture content was lower than $27 m^3 m^{-3}$ were irrigated. This period of variable rate

irrigation a total of 32.5 liters of water for the first month (five sessions) and 35.5 liters of water for the second month (thirteen sessions) was consumed. On the other days (01/06/2014 to 15/07/2014), the change of the soil moisture content was only recorded without any irrigation treatment. The soil starts to lose moisture progressively while drying up from field capacity moisture content.

3 Results and Discussion

The distribution uniformity of the majority of irrigation systems is influenced by different factors (such as sprinkler operating pressure, sprinkler spacing, etc.). During this study the irrigation water treatments were conducted in the experimental soil tank, without crop cover, under controlled laboratory conditions, and with high application effort. The applied water cannot move laterally as surface flow due the elimination action of the wood frame. The applied water can move only vertically and then laterally due to capillary action of the soil in each cell-rectangle of the experimental tank.

The results of the uniformity coefficients (CU) of the applied water in different irrigation days in soil tank surface are shown in Fig. 2. The Christiansen's coefficient of uniformity (Christiansen, 1942) was used for calculating irrigation water uniformity. The 100 % of application rate tests of CU represent the treatments where the irrigation water was applied to all cell-rectangles evenly without application losses in order to achieve rapid and uniform distribution of soil moisture at the desired values. The low application rate tests (8.3 % to 68.3 %) of CU represent these treatments, in which the irrigation water was applied only in selected cell-rectangles according to the readings of the sensor-based platform in order to improve the general DU of soil moisture in the soil tank. Therefore, the lack of uniformity in the water application affects soil moisture distribution between cell-rectangles of the soil tank.

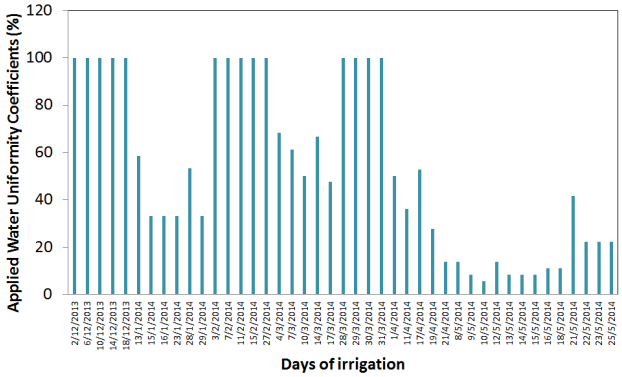

Fig. 2. Applied water uniformity coefficients during different irrigation days.

Fig. 3 shows the evolution of soil moisture distribution uniformity (DU) (Merriam and Keller, 1978) based on long-term data sets (2/12/2013 to 15/7/2014) that were

collected during dry and wet soil conditions (from permanent wilting point to field capacity) and were calculated based on the average of the lowest quarter of soil moisture measurements (9 points) dividing by average of total soil moisture measurements (36 points) in the soil tank.

In permanent wilting point (before any irrigation water treatment) the resulting soil moisture DU was 80 %. On the twenty first days during which 100% of the application rate tests were conducted (with irrigation frequency 9 liters every 4 days), DU of soil moisture was found to be declining gradually from 80 % to 40.3 %. The low DU of soil moisture, after uniform rate irrigation treatments, was due to different water infiltration rate into 36 cell-rectangles of the soil tank that affects the moisture movement in soil. Infiltration rate is unmanageable and varies both in time and space. The investigation period from 20/12/2013 to 30/01/2014, under variable rate irrigation, indicated that the soil moisture DU increased rapidly on the first fifteen days and then followed a less upward trend. In this case, it only the cell-rectangles in which the observed soil moisture was lower than 10 m3 m-3 were irrigated, and 15.25 liters of water were consumed in total. In the last period, from 01/03/2014 to 27/03/2014 of the dry soil conditions, variable rate irrigation on the soil tank was repeated, but in this time it only the cell-rectangles in which the observed soil moisture was lower than 16 m^3 m^{-3} were irrigated. However, in this period of variable rate irrigation 27.25 liters of water consumed in total and soil moisture DU remained nearly constant at 67 %. In general, the irrigation water treatments strongly affected DU of soil moisture during dry soil conditions. Constant DU can be achieved by using variable rate irrigation that is based on rigorous soil mapping techniques and schedule irrigation to specific points under the irrigator on a daily basis.

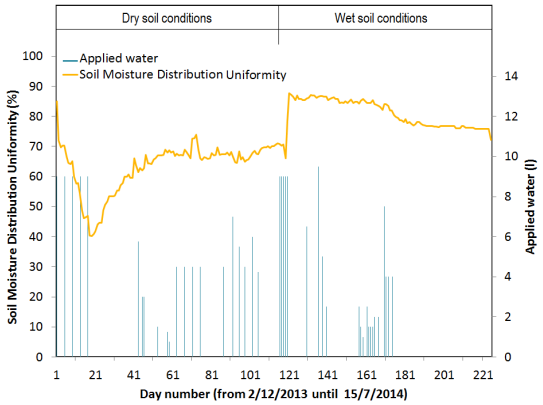

Fig. 3. Evolution of soil moisture distribution uniformity based on long-term data sets (2/12/2013 to 15/7/2014) that were collected during wet and dry conditions.

Then the DU of soil moisture in wet soil conditions near the field capacity was studied. On the first five days (28/03/2014 to 01/04/2014), the water was applied uniformly on the soil tank surface with irrigation frequency 9 liters per day. The resulting soil moisture DU was 87.7 % (significant increase). In the rest period of the wet soil conditions (01/04/2014 to 31/05/2014), only these cell-rectangles in which the observed soil moisture content was lower than 27 m^3m^{-3} were irrigated. In this

case the DU of soil moisture remains constant at 85.24 %, and 68 liters of water were consumed in total. During the last period of the wet soil conditions (01/06/2014 to 15/07/2014) without any irrigation water treatment, the resulting soil moisture DU was gradually reduced. According to the above results, DU of soil moisture was maintained at a high percentage and slightly affected by the irrigation treatments. In addition, DU exhibited lower sensitivity compared with DU in the case of dry soil conditions.

4 Conclusions

The results analysis indicates that, the irrigation water treatments strongly affect DU of soil moisture, which can be achieved by constantly using variable rate irrigation during dry soil conditions. On the other hand, DU of soil moisture maintains at high percentage and is slightly affected by the irrigation water treatments during wet soil conditions. In wet soil conditions the irrigation water is transformed and smoothed into less variable soil moisture values. Some regions of the experimental irrigated area, which received higher amounts of applied water, indicate higher soil water holding capacity than the others which received lower amounts of applied water. It is obvious that the spatial distribution of the moisture values depend more on intrinsic factors of the soil than on irrigation water distribution.

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A Comparative Study of Methods for the Estimation of the Leaf Area in Forage Species

Maria Karatassiou[1], Athanasios Ragkos[2], Phoebus Markidis[3] and Theodosis Stavrou[3]

[1]Laboratory of Rangeland Ecology (286), Department of Forestry and Natural Environment, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece, e-mail: karatass@for.auth.gr
[2]Department of Agricultural Technology, Alexander Technological Educational Institute of Thessaloniki, Sindos, 57400, Thessaloniki, Greece, e-mail: ragkosagrecon@gmail.com
[3]Laboratory of Rangeland Ecology (286), Department of Forestry and Natural Environment, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece

Abstract. Estimating the leaf area of plant species entails many benefits, such as prediction of the productive potential and the achievement of optimal management practices in irrigation, fertilization and soil use. The purpose of this study was to compare the accuracy of four methods that are commonly employed to estimate leaf area in forage species. Three of these methods are categorized as destructive and include the estimation of the leaf area using a fixed device in the laboratory (Delta-meter) and two scan software packages (Laforem and Image Tool). Leaves are scanned and data were introduced into computer for surface analysis. The fourth method is a non-destructive one, which means that leaves were not harvested and the leaf area was estimated using a portable device (Li-3100) in the field. The results indicate that Li-3100 is very accurate for species with larger leaves, while destructive methods are necessary for species with smaller leaf area (<10cm^2).

Keywords: Destructive and non-destructive methods, scanning software, portable devices, regression analysis, correlation.

1 Introduction

The estimation of leaf area (LA) is necessary to assess the development and production potential of plant species (Kozlowski et al., 1991), thus the elaboration of methods enabling accurate and easy estimates has induced physiological and plant genetics research. Leaf area is directly linked to the photosynthetic efficiency of plant communities and determines the level of carbohydrates and the accumulation of dry matter (Williams 1987, Centritto et al., 2000, Caliskan et al. 2010). Also, there are important ecological implications that are connected with the estimation of the LA including the accurate knowledge of water and nutrient use as well as the plant soil-water relations and the proper implementation of managerial practices such as irrigation and fertilization (Sousa et al. 2005, Ugese et al. 2008).

The Leaf Area Index (LAI) (Dheebakaran and Jagannathan 2009) describes the magnitude of photosynthetic activity of a plant community and constitutes an

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important indicator describing the growth capacity – i.e. the yield of a crop - and development of plant species (Kvet et al., 1971, Caliskan et al. 2010). Knowledge of the variations of this indicator throughout the growth period constitutes a measure of plant productivity, as well as a means for understanding and monitoring ontogenetic changes and growth characteristics of plant species. The maximum value of the LAI is determined by the density of cultivation, regulated by the density of planting, the application of fertilizers and crop management operations. In natural ecosystems and plant communities, the LAI depends on water balance, nutrient availability, distribution of light within the crop canopy and other environmental factors (eg temperature). The LAI is the main factor determining the rate of biomass production of a crop (CGR) (Kvet et al, 1971) due to its significant impact of the net assimilation rate (NAR) (Watson, 1958).

The efficiency of methods estimating LA is determined by their level of precision, their time requirements, the availability of proper equipment and the experimental goals (Karatassiou et al., 2013). Leaf area estimation methods are generally classified as destructive and non-destructive. The former entail harvesting leaves from the plants and their examination using instruments or specialized scan software. A popular instrument is the area measurement system device (Delta – T Devices) that measures LA in integers (cm^2). Leaves are scanned and data are introduced to specialize computer software for surface analysis, of which Laforem (Lehsen**,** 2002) and Image tool (UTHSCSA 1996-2002) have been extensively employed. The latter methods (non-destructive) do not require leaves to be harvested from the plants and are based on statistical approaches (regression analysis) and optical techniques. The prediction of the leaf area using a non-destructive method is possible by applying the general relationship LA = b*L*W where in b is a coefficient, L the length of the leaf and W the width (Montgomery, 1911). This prediction equation is simple, accurate and brief and has been proven partially successful but only for specific leaf sizes. Pioneering applications of these methods have been reported by McKee (1964) and Montgomery (1911). Most recent studies focus mainly on estimation of LA of forest and agricultural crop and only few have attempted to estimate LA in other functional groups such as grass, legumes and shrub species (Karatassiou et al. 2013)

The purpose of this study was to compare the effectiveness of various methods for the estimation of the LA for several forage plant species. In particular, the statistical analysis sought to determine whether it is possible to make easy and accurate predictions by categorizing leaves by size, regardless the species. Furthermore, the methods were tested as to their accuracy for each species. Finally, using regression analysis linear equations were estimated enabling the prediction of the LA based on linear measurements of leaves (length and width).

2 Materials and methods

The research was conducted in natural vegetation in the farm of the Aristotle University of Thessaloniki, Northern Greece (longitude: 40º31’91’’, latitude: 23º59'58’’), at an altitude of 6m a.s.l. Measurements were taken in five forage

species: *Cynodon dactylon* (L.) Pers (Grass), with leave size 0.62 – 2.27 cm^2, *Chrysopogon gryllus* (L.) Trin. (Grass) with leave size 2.00 – 9.71 cm^2, *Trifolium pratensis* L. (Legume) with leave size 2.00 – 35.34 cm^2, *Cercis siliguastrum* L. (Shrub) with leave size 17.00 – 72.67 cm^2 and *Anthemis arvensis* L. (Forb) with leave size 5.00 – 53.86 cm^2. Graph paper of various known dimensions was used (0.5- 50cm^2) to demonstrate the accuracy of the methods used to estimate the leaf area. Twelve plants of each species were randomly selected along a line. Two lines and a total of 24 plants were considered for each species (Cornelissen et al. 2003). From each plant two mature and intact fully expanded upper leaves without color deterioration and with same orientation were used. Initially the leaf area was measured in the field using the portable leaf area measurement system Li-3000A (LiCor Lincoln, Nebraska, USA). Then, the leaves were harvested and carried to the laboratory in a portable refrigerator. There, the fixed leaf area measurement device (Delta-T Devices Ltd, Cambridge, UK) was used to evaluate the LA of each species. In the following step both leaf and paper samples were scanned with the HP SCANJET 8250 scanner. Finally, the width (W) and length (L) of all leaves of each plant species were measured with a simple ruler.

Four methods for the estimation of the LAI of the five species were used and compared in this study.

A. Destructive methods.

A1. Fixed leaf area measurement device "Delta meter" (Delta-T Devices Ltd, Cambridge, UK). Delta meter is an electronic device designed and standardized under the Prom standard (ABB). The easiness of use constitutes one of the main advantages of the device, as only two buttons are enough to manage the whole process. The Delta meter measures the product LengthXWidth and shows the result on a Liquid Crystal Display (LCD) screen.

A2. Two different types of scan software

A2.1. Laforem (Lehsen, 2002) is software for image categorization especially designed for surveys regarding leaves and seeds. It uses data from conventional scanners to calculate the surface of leaves, thus being a cheap and user-friendly alternative. Care must be taken to choose the correct scale of analysis, in order to account for all the necessary characteristics of leaves; however, the application of this software could be proven complex and time-consuming for large leaves.

A2.2. Image tool (UTHSCSA 1996-2002) is an image processing and analysis software enabling illustration, analysis, compression, storage and printing of an image in grey scale. The software is compatible with other image processing packages and includes a built-in scripting language, which permits to automate tasks repeated frequently and to perform geometric transformations.

Non-destructive methods. The portable LA measurement device LI-3100 (LiCor-lincon Nebrasca USA) has been designed for biological and/or industrial applications. The samples are placed in celluloid between the drivers in the bottom surface of the portable device. Then the leaf is moved with a belt and the information is recorded at a frequency related to the speed of the belt. As the sheet moves between the drivers the image is reflected in a three-mirror system and the result is displayed on a screen (Li-Cor, LI-3100 Area Meter Instruction Manual, 1987).

The statistical analysis of the data included two parts. The first involved a correlation analysis (calculation of the r coefficient), in order to detect the method which best predicts the measured LA for smaller and larger leaves (at the 95% and 99% level). In addition, correlations were estimated between the results of each method. In the second step, a regression analysis was employed in order to formulate linear equations predicting the true LA for each one of the five species using only the linear measurements of leaves (lengthXwidth) as the dependent variable. Statistical analysis was performed using the SPSS statistical package (SPSS for Windows, standard version, release 21.0; SPSS, Inc., Chicago, USA).

3 Results and discussion

Table 1 presents the correlation coefficients between the estimated and the measured leaf area by average leaf size. It appears that all methods yield very satisfactory results. Non-destructive methods – the portable Li-Cor device - are particularly appropriate for larger leaf sizes (>10 cm, r = 0.9998). On the other hand, destructive methods seem to be slightly preferable to the use of Li-Cor for smaller leaves (<10 cm) - in particular the use of the Laforem scan software yields the most accurate results (r = 0.9974). In particular, Laforem is the most suitable for all the leaves of *Cynodon dactylon* and *Chrysopogon gryllus,* which are all under the threshold level of 10 cm^2, and the Li-Cor for all the leaves of *Cercis siliguastrum,* which are all larger than 10 cm^2. For the remaining two species the non-destructive method (Li-Cor) is more appropriate and also when leaf sizes are not categorized (r = 0.9997).

Table 1. Correlations between the measured and estimated leaf area (LA) by leaf size using various methods

Leaf size	r correlation coefficient			
	Destuctive methods			Non-destructive methods
	Image tool	Laforem	Delta meter	Li-Cor
≤10 cm^2	0.9872	**0.**9974	0.9962	0.9964
> 10 cm^2	0.9988	0.9977	0.9987	**0.9998**
0-55 cm	0.9983	0.9987	0.9990	**0.9997**

Table 2 presents the correlations between the LAs estimated for each forage species using all four alternative methods. The highest correlation is reported between the results of the two scan software methods (Image tool – Laforem). Nevertheless, it is also interesting to compare the results between the estimates of the use of the fixed device measurement system (Delta) with the remaining three. The results reveal higher correlations between the Delta and Image tool methods for *T. pretense* (LA 3- 34 cm^2) and *C. siliguastrum* (17 - 72cm^2) while the correlation between the Delta and Laforem methods is higher for the remaining three species, whose leaves are smaller on average *A. arvensis* (5 – 53 cm^2), *C. dactylon* (1 – 3 cm^2) and *C. gryllus (*4 – 10 cm^2). When it comes to predictions of the measured LA

regardless of species, i.e. when the known area of graph paper was used, the highest correlation coefficient was estimated between the results of Delta meter and Li-Cor (r= 0,989, P<0.01).

Table 2. Correlations between the estimates of leaf area (LA) yielded by the four methods

Species	Image tool - Laforem	Image tool - Delta meter	Li-Cor - Delta meter	Laforem - Delta meter	Image tool - Li-Cor	Laforem-Li-Cor
Anthemis arvensis	**0.9998**	0.9922	0.9912	0.9932	0.9963	0.9961
Trifolium pretense	**0.9996**	*0.9731*	0.9712	0.9723	0.9994	0.9993
Cercis siliguastrum	**0.9996**	*0.9873*	0.9831	0.9872	0.9803	0.9802
Cynodon dactylon	**0.9497**	0.5322	0.1744[1]	0.6039	0.5914	0.6248
Chrysopogon gryllus	**0.9948**	0.7163	0.6293	0.7349	0.9338	0.9299

[*] All correlation coefficients are significant at the 99% level except for the one marked by ([1])

In Table 3 the results of five regression analysis models are reported, where the dependent variable is the LA estimated for the five species by the most appropriate method and the independent variable is the product Length X Width for the leaves of each species. Li-Cor produced the most satisfactory results for *A. arvensis* (R^2 = 0.8645) and *T. pretense* (R^2 = 0.9616). Image tool yielded the most reliable estimates for *C. siliguastrum* (R^2 = 0.9547) and *C. gryllus* (R^2 = 0.5435).The most suitable method for the estimation of the LA of *C. dactylon* was Laforem (R^2 = 0.7072).

Table 3. Linear equations of the leaf area (LA) for five forage species (regression results).

Species	**Method**	**Linear equation (X = leaf lengthXwidth)**	**R^2**
Anthemis arvensis	Licor	LA = - 3.0188 + 9.0778X	0.8645
Trifolium pretense	Licor	LA = 0.9212 + 2.2614X	0.9616
Cercis siliguastrum	Image tool	LA = 0.8874 + 1.0637X	0.9547
Cynodon dactylon	Laforem	LA = 0.6565 + 0.2982X	0.7072
Chrysopogon gryllus	Image tool	LA =3.2727 + 0.2641X	0.5435

4 Conclusions

The use of alternative methods for the estimation of the leaf area can lead to variable results. This study shows that it is relatively easy to categorize species according to their leaf size and to estimate their LA using uniform methodologies based only on their leaf size, rather than estimating species-specific linear equations. The use of a portable device (Li-Cor) in field contitions, which constitutes a non destructive method, is very suitable for species with larger leaves on average, while destructive methods are necessary for species with smaller average LA (<10cm^2).

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The Use of Geographic Information Systems (GIS) in Environmental Education and Awareness: The Case of Hiking Trails in the Island of Karpathos-Saria Cluster

Antonios Fanariotis[1], Theodoros Papathanasiou[2]

[1]Forester - Environmentalist, Aristotle University of Thessaloniki - MSc in Forest Economics, Greece, e-mail: antonisfanariotis@yahoo.com
[2]Forester - Environmentalist, Democritus University of Thrace, Greece, e-mail: foresterpath@gmail.com

Abstract. Nowadays, the conditions of life are increasingly changed with requirements for qualitative days to form a return to nature, the environmental awareness developing into an imperative, being yet a level pressure form to the "government". Significant Push tools to empower people and turning their needs to the "natural" way of life, are the design and the information strategy and education environment. Modern information-education environment has thoroughly evolved and enriched by the use of Geographic Information Systems (GIS). Geographic Information Systems are undoubtedly applications which can highlight and restore the importance of the environment on the world stage, through various activities.

Keywords: Environmental Education, GIS application, Environmental routes, Arc Map

1 Introduction

The increasing spread of technological developments in the IT and telecommunications has made it possible to directly access to vast amounts of information every kind (Andreopoulou et.al., 2011).

The use of ICT (Information and communication, technology), and the Internet can support the educational process and awareness of students in environmental matters (Stamoulis et al, 2008). Their influence on environmental education has the following results (Stamoulis et al. 2008):

- Greater involvement of students.
- More active participation during activities.
- Facilitate and extension activities for empirical research in the classroom and at school.

The use of ICT in environmental education (EE), can support significantly the educational process, and the effort to raise the awareness of students. (Stamoulis et all, 2008).

The ICT help the learning and teaching, and also can facilitate the work of the teacher, who can utilize ICT as cognitive and investigative tool (interactive

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multimedia, simulations, educational games), as a regulatory instrument, as a communication tool (communication with various actors, students, digital libraries), as an information search tool (on line databases) (Tastsidis, Hatzimichael, and Anthony, 2010).

The rapid growth of new information and communication technologies and their penetration in the communication work production processes bring about radical changes in all areas of human activity (Castells, 1998).

One useful tool which belongs to category of ICT, absolutely is the Geographic Information Systems (GIS). Summary, regarding the definitions given for GIS occasionally, it is worth mentioning some of them. A definition of Goodchild (1985), is the following: "GIS it is one integrated system for collecting, storing, managing, analyzing and display information on geographical nature matters ". The "Integrated" means that the GIS is treated not only as a sum of machines and programs, but as a new, different technology.

One also successful definition given by Carter (1989) and according to this, GIS is "all those information systems which focus on territorial interests and phenomena at scales of all the earth until the unit property".

Geographic Information Systems have the same characteristics as the other information systems, with the additional feature of being the spatial dimension. There is large number of GIS, many of which are known by other names.

It is worth to note that an effective GIS must based on the following principles (Maniatis, 1996):

• The system to be developed must be useful to political leaders who take decisions, ie
users.

• The techniques used for the collection, processing and analysis of data, should be designed to expertise and general infrastructure that exists.

• The level of system performance and, by extension, possibilities of a computer, to comply with the needs and mainly financial capabilities and expertise.

1. The assumptions that used to derive conclusions should be mentioned clearly and unequivocally in each option programs based on information of GIS.

Applications of GIS are varied and relate to matters of nature, economic, technical issues and geographical / cartographic. GIS used for spatial and development planning in geographic and topographic applications but especially they have great use in protection of the environment and environmental education and awareness. For this reason, was made particular reference to them at the World Conference on the Environment in Rio De Janeiro in June 1992 (Chaloner, 1992).

Moreover, GIS can be correlated to the environmental education with effectively way. First of all, EE is a continuous lifelong learning process focus on the future as addressed to people regardless of their age or their field of activity extends to all stages of life (Daskolia, 2004).

Also, it is a form of education in a dynamic character, as it is not stagnant over time, but follow and absorb all social, economic, technological and cultural changes that occur in a way that is never detached from modern human life, have then and meet all environmental challenges (Tsampoulou - Skanavi, 2004).

The purpose of environmental education is the surrounding area (Georgopoulos, 1986). The spatio - temporal placement and processing of data is a key element in

any examination of issues related perivallonitkis education. It is impossible to develop an environmental education program and not to refer to factors relating to space. With the specific capabilities that have GIS in analyzing spatial data suggest that relate directly to the EE.

Facing the GIS as educational tools within the EE we can only see through the overlay of thematic maps direct correlation with the interdisciplinary approach (xalkidas et al, 1998).

In addition to, GIS can support interdisciplinary learning activities. They are a powerful tool which is possible to combine and integrate the knowledge students gain both in IT and in other subject areas such as natural sciences, literature, mathematics and foreign languages artistic (Pardalidis, 2007).

Moreover, allow to students through environmental education have better control in apokteitheisa knowledge because enhanced analytical, synthetic thinking and collaboration (disessa 2000).

Also, the possible beneficial effects of the integration of GIS in the educational process have been studied and discussed in the international education community. (Kontosi 2007). The Thomson (1987), characterizes as a source of data with which one can learn everything related to the world (Audet, 1993), while teachers who designed them environmentally recognize many advantages in their application.

Finally, Environmental education has found an ally in the effort for environmental awareness tourism and specific environmental.

Greek tourism is characterized by increased seasonality. In recent years, efforts are made to mitigate the seasonality of tourism, but also to tackle the high concentration of tourist influx in specific regions of the Greek territory. These efforts focus on creating alternative forms of tourism, one of which is the environmental-educational tourism.

The environmental-educational tourism is considered one of the most important developing tourist markets and can offer significant benefits to an area with a rich cultural elements, which are a magnet for educational / informational tourism, derived both from Greece and abroad. The environmental-educational tourism include organizing educational-information programs for students and people with environmental concerns, educational and cultural programs, awareness programs and knowledge of Greek cultural heritage and nature.

Greece, a country with rich cultural elements and excellent tourist product, and can be a magnet for people seeking to acquire special knowledge or training on issues of special interest such as the environment. Tool for the development of environmental-educational tourism is the creation of technical infrastructure, the emergence of which is constructively through the use of Geographic Information Systems (GIS). Typical examples are organized hiking trails, such as those of Northern Karpathos-Sharia.

2 Study Area

The study area of this work is the island of Karpathos. The island of Karpathos is located in the southeastern Aegean Sea between the islands of Rhodes and Crete, refraining 82 miles from the port of Rhodes (26 miles

from the edges of the islands) and 46 from the port of Sitia (40 miles edges of islands) while Piraeus is 280 miles. Km. It is the second largest island of the Dodecanese after Rhodes and possessing the highest peak (Good Lake) to 1215meters.

The island featuring intense mountainous terrain which starts from the south of the island with 508m. Mount head and culminates in the center of the 1215m. altitude. Then a mountainous backbone crosses over the island including the island of Sharia in the northern tip of the island with an altitude of 630m.

The intense mountainous terrain and poor soil productivity had as a consequence, during the last century, the migration of much of the local population and today exist on the island about 6000 inhabitants and counted about 40,000 Karpathians worldwide.

Administratively divided in Karpathos Municipality held the southern part of the island and 2/3 of the surface and the Olympus community together with the island of Sharia cover the remaining 1/3 of the island and 10% of the population.

In recent decades the development of tourism has stopped bleeding migration and there is a strong growth in this area.

Fig. 1. Satellite description of study area from Google Earth.

3 Materials and methods

For the present work, we used the Arc Map 10.2 software. It is worth to note that all the hiking routes in the island of Karpathos are twelve. We selected one of them "Route ol4" to visualize it on the map. More specifically, as base map we used a map year 2007 through the website www.ktimatologio.gr, as we can see in image 2. Using GPS, collected coordinates for the routes in EGSA 87, in significant points of the

hiking route, which have particular environmental value and we reflected them in map. In Arc Map, we created a geo database which contains shape files necessary for the creation of map, and we digitized the route, delimited it with the tool "line" of Arc Map, following the digitization standards. Furthermore, we created a map with contour as we can see in the figure 3, which can help someone to understand the difficulties of route.

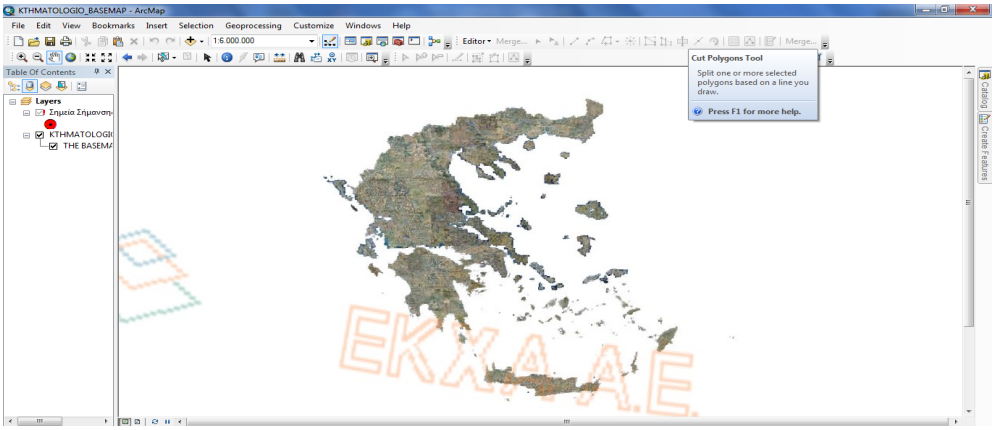

Fig. 2. Basemap that used for the work.

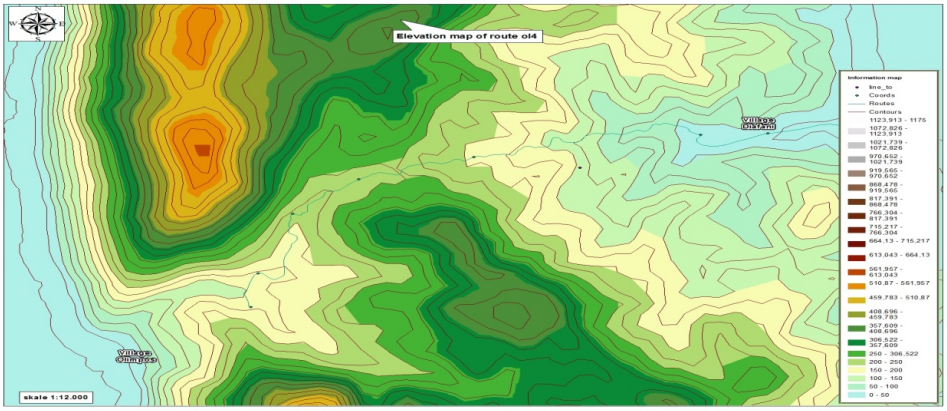

Fig. 3. Contour map.

As far as concerned the geo database, this consists of two shape files with the following names: "Coords" and "routes". The first file, consists of the coordinates (that collected with GPS) of the route and the second one, consist of the shape of the route as we can see in figure 3.

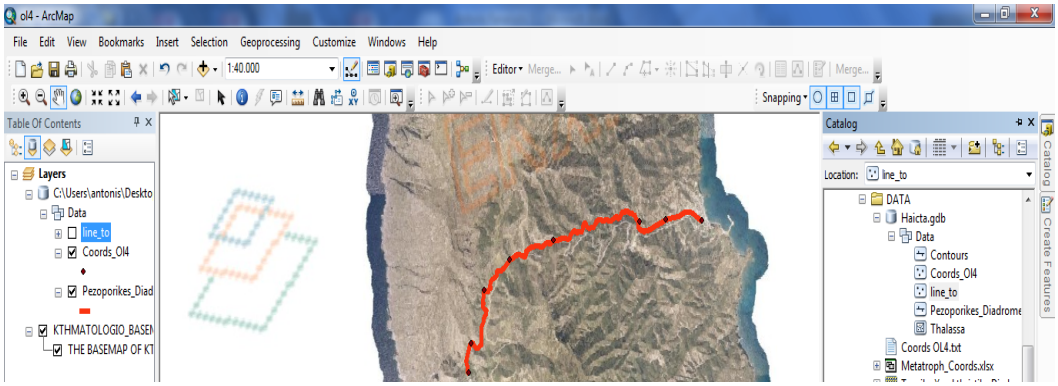

Fig. 4. Route display with red line

In addition to, using the "layout view", as we can see in figure 4, created the map of hiking routes. The map has the following scale: 1:12.000. Finally, placed an image using images from "Google earth" in the map, via the tool "insert picture" of Arc Map.

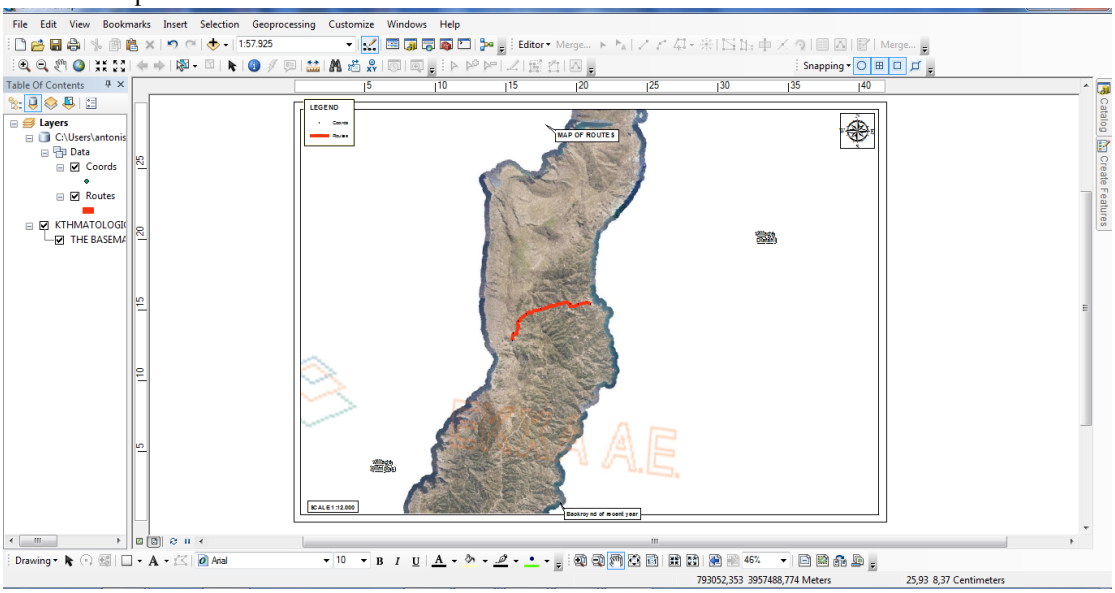

Fig. 5. Process of creation map of hiking routes.

4 Results and Discussion

We can see that GIS can contribute effectively in the environmental education with the creation maps. These maps can be the base for the EE and awareness both for visitors and students. This thematic map (image 6), can give significant information (after the import of correct shape file), which related to EE and awareness. Points of interest and a variety from physical landscapes can visualized

and give to the map an environmental side. Moreover, both the map and the general procedure creation of it can give to schools for the course of environmental education. With this way students will understand how GIS contribute in the EE. It is worth to note that the map of contour is also helpful to someone because it gives significant information about the difficulties of route.

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Land Use/Cover Changes in North Eastern Greece from 1980 to 2000

Maria Karatassiou[1], Paraskevi Sklavou[2], Zoi Parissi[2], Georgia Galidaki[2], Anna Sidiropoulou[2]

[1]Department of Forestry and Natural Environment, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece, e-mail: karatass@for.auth.gr
[2]Department of Forestry and Natural Environment, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece

Abstract. Routes of transhumance movement as well as both summer and winter destinations are subjected to intense grazing that over the years may shape landscapes. The aim of this study was to investigate land use changes in Aspropotamos area, Trikala from 1985 to 2000 that serves as a summer destination of transhumance flocks. Changes in land cover were explored with the post classification comparison approach within a GIS environment. Two maps of 1985 and 2000 were used. The results of the current paper reveal a dramatic reduction of shrubland (up to 100%) followed by grazed open forest (17.61 %) and grasslands (13.77%), while the higher percentage of increase was recorded in the forest (32.7%) followed by agricultural land (24.88%). It seems that the declining trend of transhumance grazing in mountainous areas in Greece account for both changes in rangelands and forest areas. In conclusion, transhumance serves as a critical element towards maintaining ecosystem productivity to its recent historical equilibria.

Keywords: transhumance, lowland, highland, rangelands, succession.

1 Introduction

Transhumant livestock systems are common practices in many countries worldwide accompanied by vertical movement of the livestock (Aryan 2010, O'Flanagan et al. 2011). In this system, the livestock follows the same prescribed route from lowland to highlands every year, in order to exploit the seasonality of forage production and availability, due to different rangelands altitude, throughout the year. In addition in Greece, livestock movement is a common practice from antiquity (Hadjigeorgiou, 2011), although the last decades there is a reduction in this livestock movement. Nowadays, according to the Greek Payment and Control Agency for Guidance and Guarantee Community Aid (GPCAGGCA, 2011) there is only 1 million transhumant sheep and goats. However, Chatzimichali (2007) reported that around to 1960 in Greece there were about 2 millions transhumant small ruminants. This mobility decline of sheep and goats number has important ecological implications, as herders

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stopped utilize summer rangelands. Thus, rangelands go through a stage of plant succession towards climax, decrease their forage production and biodiversity, while leads to an increasing fire risk, and dynamic landscape changes (O'Flanagan et al., 2011, Oteros-Rozas *et al*., 2013).

Last years, herders and ecologists had a debate about the transhumance livestock systems. The first group pays attention to livestock production, whereas ecologists care about the ecosystems conservation and biodiversity maintenance in grazing lands (Ayan 2010). It is known that specific characteristics of the landscape as maquis, dehesas, montados (Gomez Sal and Lorente 2004) had been formed under grazing pressure and the transhumance has an important role in this landscape shaping (Gomez Sal 2000, Sklavou et al., 2014).

A common method for quantifying land cover changes is the comparison between two classified land cover maps (Foody, 2001, Fuller et al., 2003; Poyatos et al. 2003; Lu et al., 2004), namely post-classification comparison. However, the accuracy of the post-classification comparison is totally dependent on the accuracy of the initial classifications (Coppin et al. 2004).

The aim of this study was to investigate the land use changes in Aspropotamos area from 1985 to 2000.

2 Materials and Methods

The study was conducted in the enlarged community of Aspropotamos area in West part of Regional unit of Trikala (Fig 1) at an altitude above 700 m to 2379m. The most part of the study area were taken place among the mountains Lakmos, Athamanika and Koziakas. This survey has covered an area of 94.111 ha and its largest part is covered with grasslands, shrublands and forests and mainly used from transhumant livestock from May to October.

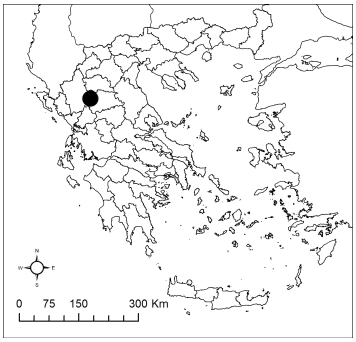

Fig. 1. The experimental area of Aspropotamos, Trikala.

For the land cover change detection, the post classification comparison approach was implemented, within a GIS environment. Two maps of 1985 and 2000 were used. For the land cover classification in 1985 a digital map of Forest Vegetation and Land Cover, by the former Ministry of Rural Development, was used. This was

based on an aerial photography survey around the year 1985 and is of 1:50,000 scale. The classes of this map were indicative of the classification scheme designed and they were merged to suit the purposes of our study.

The Corine Land Cover 2000 (CLC2000) vector map was used to provide land cover information for the year 2000. CLC2000 is based on classification and digitizing of features on satellite imagery, with 100 m positional accuracy and 25 ha minimum mapping, and is of original scale1: 100,000. 21 out of the 44 CLC classes were found in the study area, which were merged into the 5 classes of the classification scheme adopted in this study (Table 1).

Table 1. Classification scheme

Land use categories	Description
Grasslands	Areas dominated by herbaceous plants, with ground cover of woody vegetation < 10%
Shrublands	Areas dominated by evergreen woody shrubs with sclerophyllous leaves
Forest-rangeland	Areas dominate by herbaceous plants, with ground cover of woody vegetation between 10% - 40%
Forest	Areas with relative tree cover higher than 40%
Agricultural land	Fields with permanent or temporary crops
Other Areas	Areas with manmade features, including villages, rocks etc.

3 Results and Discussion

The land use/cover classification for the experimental area in 1985 and 2000 presented in Figure 1. Although the study period is only 15 years there are obviously differences in land use categories.

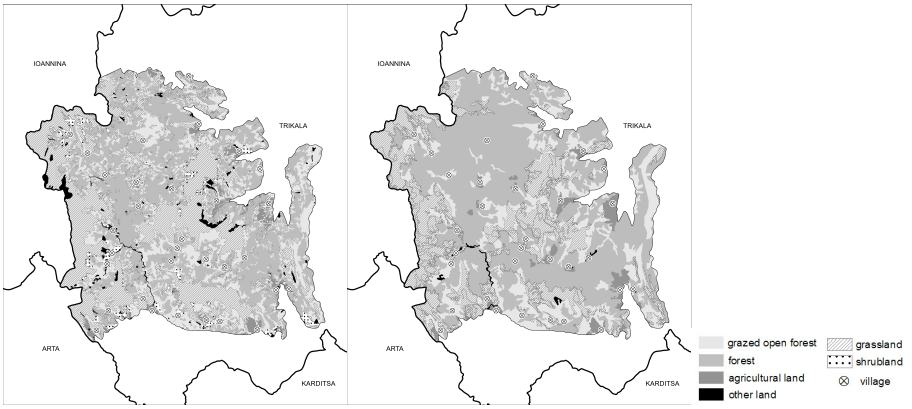

Fig. 2. The land use/land cover in experimental area of Aspropotamos in 1983 and 2000.

A decrease in rangelands (grasslands, shrublands, and grazed open forest) was detected during the study period. On the other hand, an increment of forests and agricultural lands in hectares were recorded (Table 2). Moreover, the higher percentage of reduction was recorded in shrublands (100%) following by grazed open forest (17.61 %) and grasslands (13.77%) while the higher percentage of increase was recorded in land use category of forest (32.7%) following by agricultural land (24.88) (Figure 3).

Table 2. Land uses (ha) in the study area during the period 1985-2000

Land uses	Years	
	1985	**2000**
Grassland	28,946	24,959
Shrubland	3,301	0
Grazed open forest	22,238	18,322
Forest	36,789	48,820
Agricultural land	2,815	3,516
Other land	2,021	494
Total	**96,111**	**96,111**

Moreover, the increment in agricultural land presented in the north east part of the experimental area (Table 2, Figure 2,3) as in this part there are many villages with agrarian societies. On the other hand, the above changes in rangelands and forest areas are expected as there is a decline trend of transhumance grazing in mountain areas in Greece (unpublished data) and other Mediterranean countries (Oteros-Rozas et al., 2013, Ainalis et al., 2015). Reduced transhumant livestock system may be due to various socio-economic factors that have significantly influenced the lifestyle of herders (Sklavou et al., 2014).

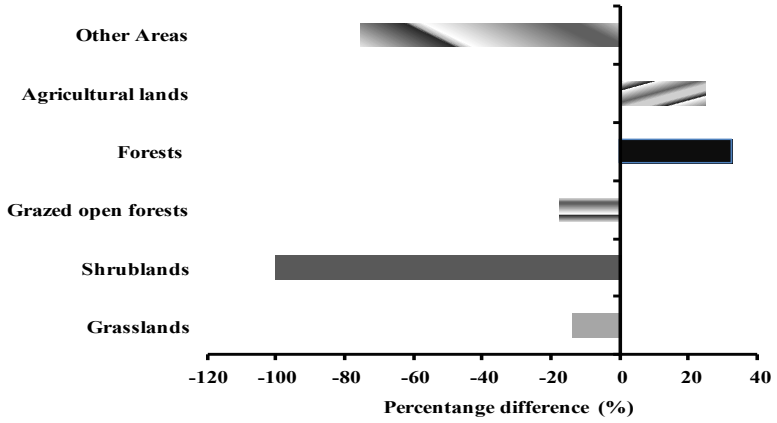

Fig. 3. Changes (%) of land use in Aspropotamos area during 1985 and 2000.

The abandoned of traditional livestock system has a significant influence in the landscape shaping in mountainous ecosystems and rural area (Hatfield and Davies 2006). Spatial pattern of grazing creates habitat heterogeneity in the landscape and influences species richness in different ways.The rangelands lost their biodiversity and presented more homogenous. Additionally, the decrease in shrublands and grazed open forest has as result their encroachment and reduction of the open patches (Figure 1) which are useful not only for the small ruminant feeding but there are habitats for wildlife animals (Olea and Mateo-Tomas, 2009).

4 Conclusions

It seems that is important to encourage the herders to keep alive the transhumance livestock system in order to benefit the ecosystem and maintain the landscape conservation. In Greece as a Mediterranean country with semi arid climate the maintenance of transhumance livestock system is critical element towards maintaining ecosystem productivity to its recent historical equilibria.

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Countries Clustering with Respect to Carbon Dioxide Emissions by Using the IEA Database

Miltiadis Chalikias[1], Stamatis Ntanos[2]

[1]Technological Educational Institute of Piraeus, Department of Business Administration, Egaleo, 122 44, Greece, e-mail: mchalik@teipir.gr
[2]Democritus University of Thrace, Department of Forestry and Management of the Environment and Natural Resources, Orestiada, 68200, Greece, e-mail: sdanos@mycosmos.gr

Abstract. The purpose of this study is to use clustering variables according to the Kaya identity, an equation involving energy consumption, economic growth and carbon dioxide emissions. By using aggregate data from the International Energy Agency for a dataset of developed and developing countries, we perform clustering according to variables such as population, gross domestic product (GDP), total primary energy supply (TPES) and total CO_2 emissions. We use the estimated clusters to have an overview of the relationship between economic development and carbon dioxide emissions.

Keywords: Carbon emissions, Kaya identity, cluster analysis

1 Introduction

Rapid economic development during the last century led to an increase in the concentration of greenhouse gases in the atmosphere, especially carbon dioxide (hence CO_2). Carbon emissions are a negative byproduct of burning fossil fuels mainly for energy and transportation purposes. Global carbon emissions from fossil fuels follow a rising pattern since 1900. Emissions increased by over 16 times between 1900 and 2008 and by about 1.5 times between 1990 and 2008 (EPA, 2015).

Data for energy consumption provided by the International Energy Agency concerning the year 2012, reveal that North America has a mean energy consumption of about 6.8 toe / person (toe stands for tons of oil equivalent), the EU 3.46 toe / person, while for non-OECD countries the index is 1.34 toe / person. These important differences confirm that the level of prosperity and the development rate of the countries associate positively with energy consumption. A higher standard of living means more energy consumption and hence more CO_2 emissions. European Union countries have stabilised energy consumption during the last decade due to Kyoto Protocol commitments. China on the contrary shows an impressive energy consumption increase, due to intense industrialization. Carbon emissions on a global scale reached 31.7 billion tons in 2012, from 14.08 in 1971, an increase of 125%. Analyzing further in OECD and Non-OECD countries, we notice that emissions increase in Non-OECD countries is significant higher. Specifically, while in OECD countries there is a 30% CO_2 emissions increase between 1971 and 2012, the

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emissions have tripled in non-OECD countries during the same time period (IEA 2014).

2 Literature Review

According to the International Energy Agency, an equation, proposed by Kaya (1990; 1997) can be used in order to estimate the level of human effect on earth's atmosphere. This index, known as Kaya identity states that aggregate CO2 emissions can be estimated as the result of four inputs: Carbon content of the energy consumed (or carbon efficiency), Energy intensity of the economy, Production per person (per capita GDP), and population.

$$CO_2 = \frac{CO_2}{TOE} * \frac{TOE}{GDP} * \frac{GDP}{POP} * POP \quad (1)$$

By using this basic index, CO_2 emissions can be calculated for a country, region or on a global scale and we can also test different greenhouse gas emissions scenarios scenarios.

According to a recent paper by Ntanos et al. (2015), the relation between economic growth and CO_2 emissions was tested by using One Way ANOVA. The results indicated that there is a positive correlation between GDP, energy consumption and CO_2 emissions for the electricity sector and a negative correlation for the transportation sector. According to Zafeiriou et al. (2011) economic growth is linked with energy use while the uneven distribution of fossil fuels around the globe may lead to countries conflict. The turn to renewable energy sources can help in countries energy security and help environmental protection. More specific it was found that the substitution of fossil fuels with biomass can potentially contribute to the reduction of the greenhouse effect.

In an interesting study concerning CO_2 emissions and financial performance of firms, it was found that the performance of environmentally responsible firms is negatively related to an increase of global CO_2 emissions. This implies that there is a category of "green" investors that are interested in the environmental attitude of corporations. In our opinion this approach can be applied not only for firms but also for countries evaluation (Sariannidis et al. 2013).

Concerning the contribution of renewable energy sources (RES) in reducing CO_2 emissions there is a plethora of publications. In a paper revealing the attitudes of Greek citizens on environmental issues, it was found that citizens are willing to invest in RES, especially for residential applications. The public's high level of awareness on RES can reduce national carbon dioxide emissions and contribute to GDP growth, by creating jobs and increasing people's income (Tsantopoulkos et al, 2014).

3 Results

Cluster analysis was performed by using variables of CO_2 emissions in tons per capita, GDP in USD per capita and Total Primary Energy Supply (TPES) in tons per capita. Firstly hierarchical cluster analysis was used and from the Agglomeration schedule the number of clusters where estimated (it was found that 3 clusters exist). With K-Means Analysis for the three clusters the following results were obtained:

Table 1. Cluster distribution with number of countries included in each cluster

Cluster Distribution

		Number of countries	% of Combined	% of Total
Cluster	1	91	65.0%	65.0%
	2	36	25.7%	25.7%
	3	13	9.3%	9.3%
	Combined	140	100.0%	100.0%
Total		140		100.0%

Three clusters were estimated as we can see in table 1. The countries names included in the clusters are given below.

First Cluster In the first cluster 91 developing and underdeveloped countries are included.

Second Cluster: Australia, Israel, Japan, Korea, New Zealand, Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Poland, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom, Belarus, Cyprus, Kazakhstan, Malta, Russian, Federation, Turkmenistan, Malaysia, Singapore, Chinese Taipei, Hong Kong, China, Islamic Rep. of Iran.

Third Cluster: Canada, United States, Iceland, Luxembourg, Brunei, Netherlands Antilles, Trinidad and Tobago, Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates.

Table 2. Cluster profiles (mean of GDP/cap, CO2 emissions/cap and energy consumption/cap)

		GDP per capita in USD		CO2 Emissions in tons per capita		Total Primart Energy Supply in toe per Capita	
		Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Cluster	1	7784.3	5095.6	2.29	1.93	1.07	.69
	2	28942.5	10546.1	8.45	2.67	3.79	1.15
	3	50515.0	26529.0	20.57	7.47	10.52	4.14
	Combined	17192.9	17410.6	5.57	6.26	2.65	3.14

In table 2 we can see the average GDP/cap, the average CO_2 emissions/cap and the average energy consumption in toe/cap for each cluster. We observe that the 3d cluster includes countries with the highest GDP which are the main world oil producers, while the 2nd cluster includes developed countries and the 1st cluster included undeveloped countries. We observe that CO_2 emissions and energy supply are positively related to economic development as expressed by GDP per capita.

4 Results

Using a database from IEA, we found that there is a correlation between economic development and CO_2 emissions. We observe that the clusters effectively divide countries mainly depending on GDP per Capita criterion. Clusters depict rich countries with a high production of oil, developed countries and undeveloped countries. The results reveal that economic development is associated with intense energy consumption and CO_2 emissions and reinforce the conclusion that developed countries are the major CO_2 polluters.

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Management Zones Delineation in Olive Grove Using an Unmanned Aerial Vehicle (UAV)

Athanasios Gertsis[1], Christos Vasilikiotis[2] and Konstantinos Zoukidis[2]

[1]Department of Environmental Systems Management, Precision Agriculture Laboratory, Perrotis College, American Farm School, Thessaloniki, Greece, e-mail: agerts@afs.edu.gr
[2]Department of Environmental Systems Management, Precision Agriculture Laboratory, Perrotis College, American Farm School, Thessaloniki, Greece

Abstract. The use of aerial photos taken in a low altitude with UAVs (Unmmaned Aerial Vehicles) is recently becoming a common practice in many areas. The use for agricultural related applications is applied in this study, using a common vegetation index, namely NDVI, to identify areas of large differences in crops grown in order to delineate Management Zones to be eventually used for Precision Agriculture applications. A UAV equipped with an infrared camera was used to develop maps of NDVI in an olive grove along with ground measurements of NDVI, to provide ground truthing information. The results were used to identify areas of small or large differences and to establish Management Zones (MZs) for further evaluation and application of precision agriculture inputs.

Keywords: UAV (Unmanned Aerial Vehicle), NDVI (Normalized Difference Vegetation Index, Management Zones (MZs), remote sensing, ground truthing, olive grove, vineyard, Precision Agriculture

1 Introduction

The first step in application of Precision Agriculture's (PA) methods is to evaluate if any significant "spatial" and "temporal" variability exists in the farmer's field. This results to establishment of digital maps and delineation of Management Zones (MZs) for important soil and crop properties affecting growth and productivity. The technologies developed and become commercially available in the in the last ca.20 years, provided tools to achieve this evaluation. In addition and in the recent years, a new tool became available, the use of unmanned aerial vehicles (UAVs) which has extended to many applications such as agricultural management, civilian applications, homeland security, forest fire monitoring, quick response surveillance for emergency disasters et al. This preliminary study attempts to combine "aerial sensors" to facilitate delineation of MZ in a recently established olive grove.

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2 Materials & Methods

The study area is located at the premises of the American Farm School, Thessaloniki Greece and includes a recently established olive grove, where high and super-high density systems adapted for mechanical harvesting are evaluated in a long-term assessment. A UAV (Figure 1) equipped with a camera with R-G-B-NIR filters and a GPS for georeferencing the pictures, was used to obtain the NDVI (Normalized Difference Vegetation Index) data. In addition a hand help NDVI sensor (Trimble® GreenSeeker) was used to measure NDVI at ground level, to provide similar "ground" data for correlation with the "aerial" values.

Fig 1. The UAV used for the study to obtain "aerial" NDVI data.

Fig 2. The hand held sensor use to obtain NDVI data at "ground" level.

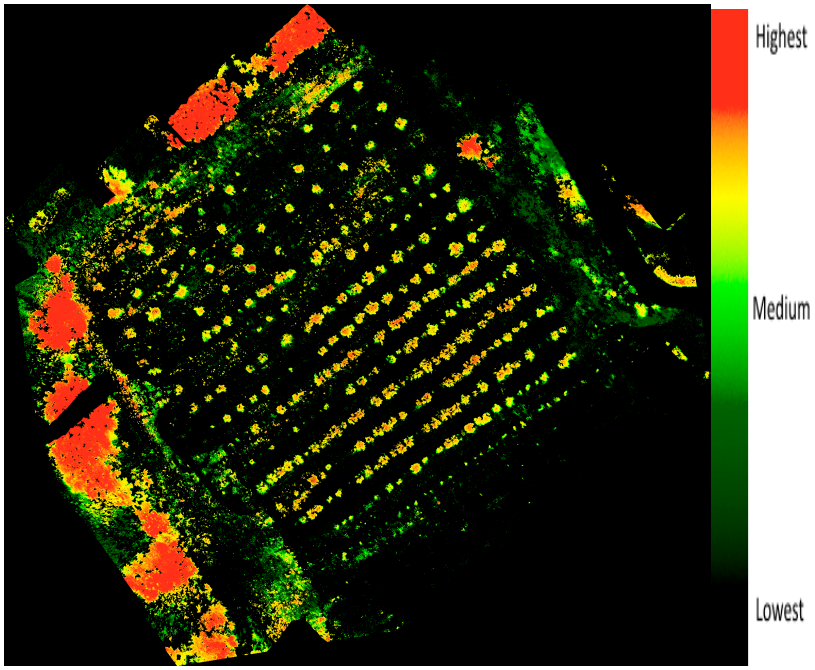

Fig. 3. The NDVI range of the entire olive grove- data by UAV's camera

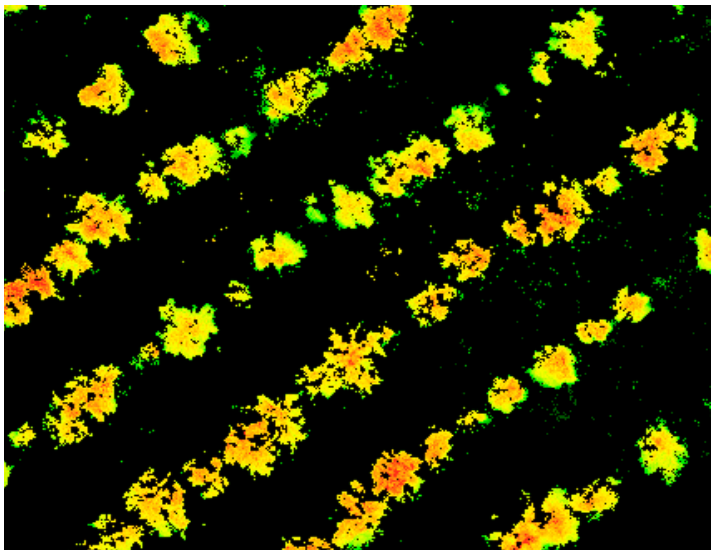

Fig. 4. A selected portion of NVDI from olive trees – data by UAV's camera

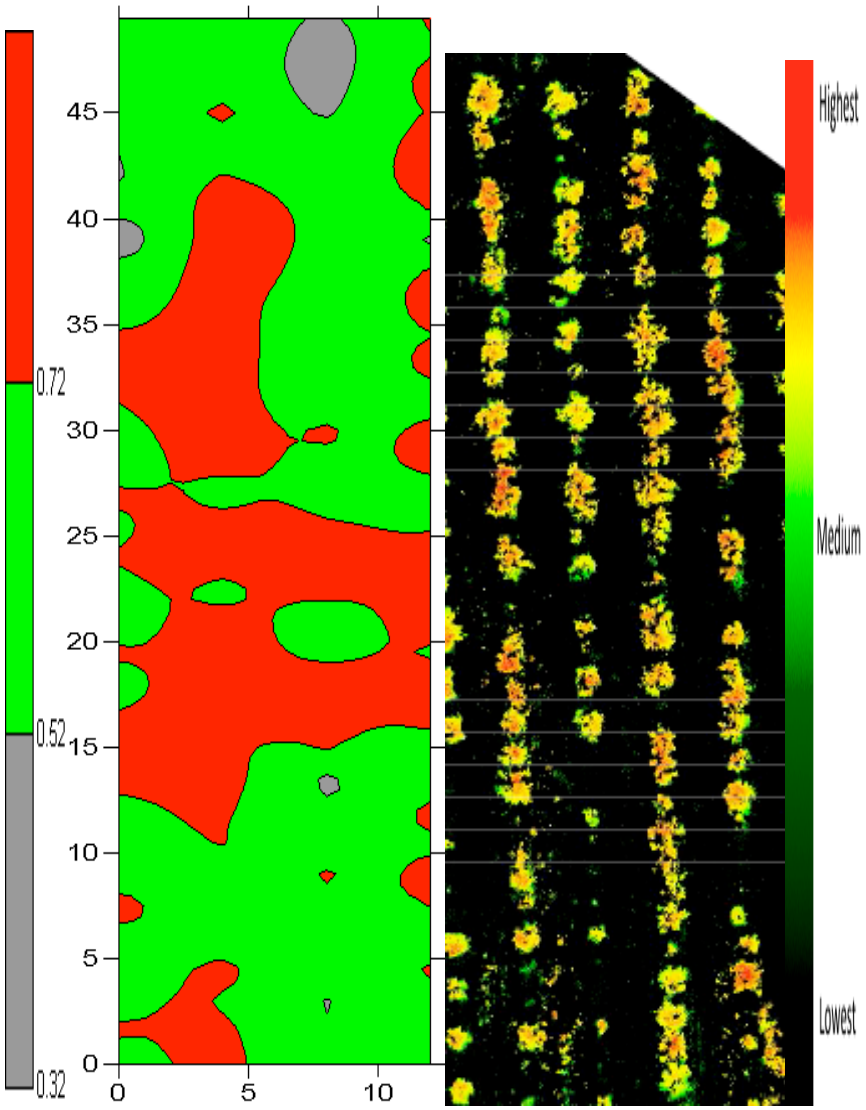

Fig. 5. The NDVI of the selected area shown in Fig.4 in the olive grove, measured using the ground NDVI sensor.

3 Results & Discussion

The aerial data are shown for the entire olive grove in Fig. 3 and for a small selected section, magnified, in Fig. 4. The ground measured NDVI of the selected area is shown in Fig.5, where two distinct areas are visualized. These two areas appear to be similar with the more detailed NDVI values obtained from the UAV's camera. Further analysis of data will provide more close evaluation of the two MZ's established. The results from a general approach used – to facilitate extrapolation for farmer's use- to delineate MZ indicated that a combination of aerial and ground data can be used to provide a "manageable" size MZ. It is important to "think at the farmer's level" when designing MZ, especially considering the small size farm area at which most farmers exercise cultivations and other management practices. This study presents preliminary data, to evaluate "spatial variability". More data are in progress to further validate the "temporal variability" needed, in order to conclude the delineation of MZs on a time basis. The correlation was good for the olive grove section- partial data section used only in this report-, while there is no consistent correlation in the vineyard, due to inadequate database. Note: Data analysis of new datasets for both crop species, is under evaluation but not presented in this report, due to time constraints.

The ground data provided also in previous year measurement from the olive grove, indicated two very distinct areas of NDVI (Gertsis et al. 2013). Candiago et al. (2015) demonstrated he great potential in terms of speed, cost and reliability, of high resolution UAV data, combined with additional photogrammetric methods. Bendig et al. (2014) used UAV for estimating crop biomass, another area of important application. However, none of these studies had the aerial NDVI to be correlated with ground NDVI data, to provide a means of comparison. In general, there is a gap in validation studies for remote and ground data; therefore, more work is required on this subject, to provide simple and reliable means of delineating MZs at farmer's field level with either aerial or ground sensors.

4 Conclusions

The use of UAV's is currently applied in many areas of interest with a exponential increase of uses. Particularly the applications in agricultural production and environmental studies indicates a high prospect of significant contribution; however, the use of data provided by UAV's should be coupled and validated in most cases, by related data taken at ground level (soil-crop) in order to expand and verify the "extrapolation" to potential beneficial uses. This study is an example of such a "relational" verification. The study is in progress and more data are collected for further and more accurate validation data sets.

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Thermal Insulating Characteristics of Cork Agglomerate Panels in Sustainable Food Buildings

Francesco Barreca[1], Carmelo Riccardo Fichera[2]

[1]Università degli Studi Mediterranea di Reggio, Dipartimento di Agraria, Italy,
e-mail: fbarreca@unirc.it
[2]Università degli Studi Mediterranea di Reggio, Dipartimento di Agraria, Italy,
e-mail: cr.fichera@unirc.it

Abstract. Over the last few years, the building industry has been focusing on research, on the construction of passive houses and on the use of natural, local materials that are non-toxic, recyclable and can assure high thermal insulation. Cork is a natural material whose qualities have been known since ancient times and which fully meets sustainability requirements. Cork granulate is a sustainable solution that recycles a waste product, which substantially keeps the characteristics of the original material, turning it into a resource for manufacturing new products, such as insulating panels made up of cork agglomerate, which are increasingly used in the building sector. In this paper, certain thermophysical parameters of six panels of cork agglomerate are evaluated. The tested panels of granulated cork showed thermophysical characteristics similar to those of the cork bark and even highlighted a higher diffusivity value than natural cork. Ultimately, it may be assumed that the panels of agglomerated cork are a suitable and sustainable solution particularly for the thermal insulation of buildings in hot climate areas and where a healthy environment is required, e.g. where agri-food products are processed and stored.

Keywords: Cork agglomerate, insulation, agri-food, thermal conductance.

1 Introduction

Over the last few years, the building industry has been focusing on research, on the construction of passive houses and on the use of natural, local materials that are non-toxic, recyclable and can assure high thermal insulation (Barreca 2012). Cork is a natural material whose qualities have been known since ancient times and which fully meets sustainability requirements. It is obtained from the bark of an oak, the *Quercus suber,* which is widespread in Portugal, Spain, North Africa and in a few areas of Italy. Its characteristics have long been known: already in the 1st century, in his *Naturalis Historia,* Pliny the Elder recommended to use it for its high insulating capacities. In the studies on plant anatomy, cork plays a crucial role since it was the first plant tissue to be examined under a microscope, described and drawn (Hooke 1664). It is a very homogeneous and compact parenchymatous tissue with a

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oneycomb-like structure (Pereira, 1998). This peculiar structure and the suberization of its cell walls make them similar to watertight compartments, owing to the presence of a large amount of gas in the suberose cells. As a result, they are also considerably light, very elastic, impermeable to liquids and gases and thermally and sound insulated (Palma 1986). Finally, cork is strong and quite resistant to the enzymes secreted by parasites, since suberin is one of the most resistant organic substances. Though it is widely grown, the regeneration of its bark is slow: it takes over 10 years on average to regenerate after the first barking, which usually takes place 20-25 years after the birth of the plant. That is why cork, and above all first-class cork, is a valuable material. High quality cork is mainly used to produce bottle stoppers and, owing to the manufacturing process, over 75% of it becomes a waste product (Colagrande, 1996). On the other hand, a large amount of waste cork comes from industry, from forest cleaning and pruning and from waste selection. Such a material is then recycled and triturated to obtain the so-called cork granulate (ISO 1997; 1972).

Cork granulate is commonly used in the building sector as bulk material in the air gaps of curtain walls; it is added to plaster to produce thermal insulating panels (Cherki et al., 2014); or mixed with asphalt (Pereira 2013) or with lightened mortar (de-Carvalho et al. 2013). Cork granulate is a sustainable solution that recycles a waste product turning it into a resource for manufacturing new products (Rives et al. 2012). Recently, insulating panels made of agglomerated cork have been introduced in the building sector. They are offered in various versions depending on the glue used, on gradation and specific density. In particular, since the type of glue used to make the panel influences the final mechanical and thermal behaviour, various types of synthetic and natural glues were tested (urethane, melaminic and phenolic resins) (Gil 2009). However, a special building method allows using only the typical resin of cork (suberin) to glue granules. Such a method entails overheating granules (or using high-frequency ultrasounds) to soften the suberin and the lignin that make cork granules expand and bond together. In this paper, certain thermophysical parameters of six panels of cork agglomerate are evaluated. Different constituent characteristics of the panels, such as grain size distribution, density and thickness, were taken into account in order to evaluate how they may influence thermal insulating performances.

Nomenclature

Λ_t	conductance to time t [$Wm^{-2}K^{-1}$]
$q(t)$	instantaneous density of heat flow rate at time t [Wm^{-2}]
$T_h(t)$, $T_C(t)$	instantaneous temperature at time t on the internal and external surface of the sample at time t [K]
ΔQ	shift heat flow [W]
ϱ	bulk density [kgm^{-3}]
V	volume [m^3]
c	specific heat capacity [$Jkg^{-1}\ K^{-1}$]
ΔT	temperature shift [K]
Δt	time shift [s]

$Q_h(t), Q_c(t)$	heat flow across the internal and external surface of the sample at time t [W]
d	thickness of sample [m]
A	surface area of sample [m^2]

2 Materials and Method

The six analysed panels are commonly sold on the Italian market to insulate walls and roofs. Five panels are made of blond cork and one is made of expanded toasted brown cork (dark agglomerate). (fig. 1). Three 0.45x0.45 m samples were taken from each panel to test gradation, density, thermal conductivity, heat capacity and thermal emissivity. In order to apply Fourier's law, which is essential to calculate the thermophysical properties of materials, agglomerated cork panels thicker than the average size of the basic elements of the material were considered (Bonacina et al. 1984).

Fig. 1. Testing specimens of agglomerate cork panel.

1. Size analysis and bulk density

Panels were characterized by three different gradations. A size analysis (ISO 2030) was performed through mechanical sieving by taking three 100g samples from each bulk gradation (BL 1, BL 2, BR) and using mesh apertures conforming to the series ISO/R 40/3 and a balance with accuracy 0.1 g. The calculated average values allowed constructing the relative cumulative percentage retention curves (Fig. 2).

The bulk density was measured by averaging the measurements taken on the three samples of each panel according to ISO 2189. The size of the samples was measured to the nearest millimetre and at constant temperature and environmental humidity.

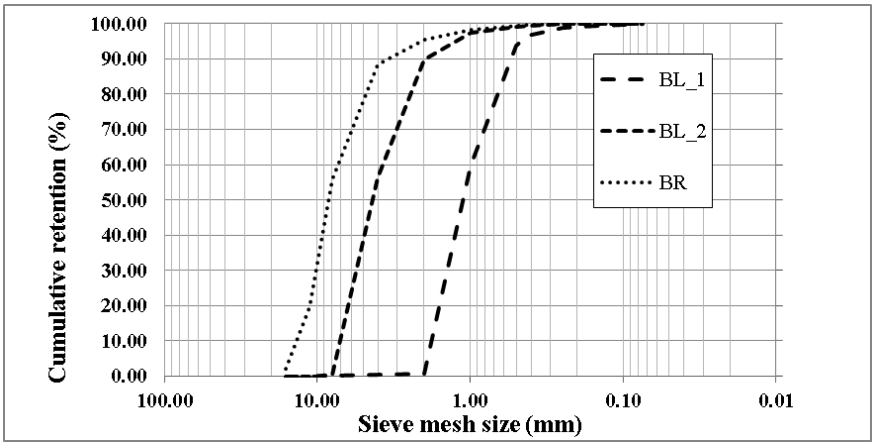

Fig. 2. The cumulative percentage retention curves for the three different cork granular materials. Semi granular scale.

Table 1. Physical properties of investigated samples.

Sample	Granulate type cork	Thickness [m] · 10^{-2}	Weight [kg]	Volume [m^3] · 10^{-6}	Bulk density [kgm^{-3}]
A	BL1	1.38	1.06	2872.06	369.35±0.01
B	BL1	1.10	0.86	2283.38	375.95±0.02
C	BL1	2.90	2.35	6035.48	389.71±0.01
D	BL2	2.10	0.65	4467.02	145.85±0.01
E	BL2	2.90	0.96	6115.26	157.02±0.01
F	BR	1.95	0.53	4845.79	108.70±0.01

2. Thermal conductance

A testing apparatus, similar to the one the authors had employed in a previous work (fig. 2) (Barreca and Fichera 2013), was used to implement the procedure described by ISO 9869, *Thermal insulation – Building elements – In-situ measurement of thermal resistance and thermal transmittance*, and to evaluate the thermophysical properties of the panels under conditions similar to those of their actual use, i.e. for the thermal insulation of walls in buildings located in hot climate areas. This simple and easily portable apparatus is composed of a cold insulated box whose internal temperature ranges from 26° and 2° C, thanks to a refrigeration system. The panel to test is fixed to a side of the box and the box is placed in a confined environment with a temperature of 20-40°C controlled by an automatic heating system that turns on at preset intervals to simulate the dynamic variations of the external temperature in the hot seasons of the Mediterranean climate. Four surface temperature sensors and a heat flowmeter (HFM) were attached at the centre of the inner and outer faces of each sample to measure continuously the heat flow

passing in both directions. With a view to limiting mutual interferences, sensors were placed in a symmetrical but offset position.

All the sensors of temperature, of surface heat flow, of air temperature and humidity of the environment inside and outside the cold box are networked by data loggers, which acquire and store the values taken at intervals of 300 s. A thermal infrared camera allowed verifying the homogeneity of the surface temperatures of the samples as well as possible heat losses or hidden sources of thermal radiation. After 72 hours of measurements and, however, after checking certain conditions imposed by ISO 9869, such as a constant difference in temperature between the hot and cold spaces higher than 10°C and a heat flow >5 W/m^2, the instantaneous conductance was calculated by means of (1)

$$\Lambda_t = \frac{q(t)}{T_h(t) - T_c(t)} \tag{1}$$

The final conductance value was obtained by applying the progressive average method to (1) throughout the testing period.

Table 2 shows the values obtained for each panel.

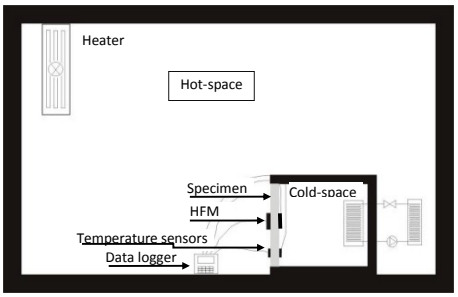

Fig. 2. Testing apparatus used for the insulation analyses on the samples.

3. Heat capacity

The specific heat capacity is a thermophysical parameter particularly significant for insulating materials since, together with density and thermal conductivity, it enables to calculate the thermal diffusivity of the material, which is a peculiar parameter of the speed of temperature variation between the two faces of a wall. Moreover, it allows calculating the phase lag of the thermal wave, a phenomenon extremely useful to mitigate temperatures inside buildings in hot climate areas.

Considering the limited thickness of the samples, their heat capacity was measured through a simplified procedure by applying the transient method (Wakili et al. 2003) to the apparatus described above. The temperature variation inside the confined environment, which occurred at regular 2-hour intervals, led to a cyclic, transient heat transfer. As a matter of fact, the variable heat difference between the confined environment and the inside of the cold box originated a variable heat flow that passed through the tested sample and was measured when entering and exiting it

by means of the two heat flowmeters placed on both faces. The following can be derived from the general conduction equation in finite terms:

$$\Delta Q = \rho V c \, \Delta T / \Delta t \qquad (2)$$

As a result, referring to the time interval, which corresponds to the turn on/off cycle of the heating system outside the cold box, and assuming a linear temperature variation inside the sample, the following is obtained from (2):

$$c = \sum_{t=0}^{t=\Delta t} [(Q_h(t) - Q_c(t)) \, \Delta T_t] \Delta t \rho A d \qquad (3)$$

Specifically, the values of heat capacity shown in the table were obtained from the average of three samples of the same panel for a turn on/off interval of the heating system of 120 min.

Assuming a one-dimensional heat flow, numeric check of the data from the measurements taken with the testing apparatus were carried out with an RC-model by means of the system identification technique of LORD 2000 (L.Ljung 1999). Fig. 3 shows the model of the system.

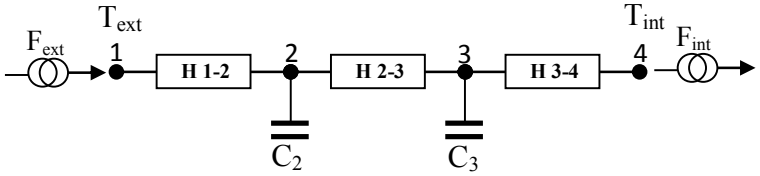

Fig. 3. RC-model of the testing apparatus

By analogy, the RC-model shown in Fig. 3 represents the thermophysical behaviour of the tested sample. In particular, the sample was schematized by two internal nodes (2 and 3) and by two edge nodes (1-4). Resistances H 1-2, H 2-3, H 3-4 represent heat resistance, while capacities C2 and C3 represent the overall heat capacity of the sample. Node 1 was associated to the values of the flows and temperatures measured on the outer face of the sample, while node 4 was associated to the values of the flows and temperatures measured on the inner face of the cold box. The software LORD solves the system considering the values measured during the transient period. Particularly, the temperature measured at node 4 and the flow measured at node 1 were considered as output values for the correction of the calculated values.

4. Emissivity

Infrared thermography was used to calculate the emissivity of the panels. In particular, samples were heated at a temperature of about 40±5°C (fig.4.) by means of electrical plates positioned at the centre of their faces, where a strip of black dielectric material with emissivity equal to 0.97 was also applied. The surface temperature of the dielectric material and of the sample was measured with a contact

thermometer. Then, the emissivity value of the cork agglomerate sample was obtained through a software programme for the analysis of infrared images assuming that the infrared measured temperatures coincided with the contact measured ones. The analysis of the emissivity values of each sample showed a significant difference between the faces of the same sample. Such a difference may be due to the different surface finish. Actually, because of the different granulate sedimentation during the compression and heating phases and the consequent expansion of the panel, the finest part of the granulate settles more on one of the two faces, thus determining a more compact surface and a lower presence of gaps.

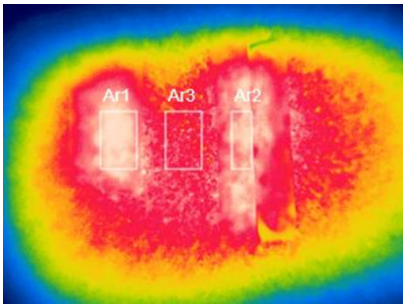

Fig. 3. Thermal infrared image of a sample of panel

Table 2. Thermal properties of investigated samples

Sample	**Conductance** [$Wm^{-2}K^{-1}$]	**Conductibility** [$Wm^{-1}K^{-1}$] · 10^{-1}	**Capacity** [JK^{-1}]	**Diffusivity** [m^2s^{-1}] · 10^{-8}	**Emissivity**
A	5.51±0.69	0.77±0.10	3033.50±382	7.26±0.91	0.93±0.005
B	7.52±0.95	0.83±0.10	2457.20±309	7.70±0.97	0.91±0.004
C	2.79±0.35	0.81±0.10	4644.60±585	10.5±1.32	0.93±0.000
D	2.52±0.32	0.52±0.07	2491.90±314	9.38±1.18	0.94±0.021
E	1.76±0.22	0.54±0.07	3099.70±390	10.6±1.33	0.92±0.001
F	2.27±0.29	0.47±0.06	2452.70±309	7.75±0.97	0.93±0.013

3 Results and discussions

Table 2 shows the results obtained. The analysis of the values demonstrates that the cork agglomerate panels have thermophysical characteristics similar to those of natural cork (Silva et al., 2008), which, however, has a value of thermal conductivity slightly lower (0.045 $Wm^{-1}K^{-1}$) than the average value of the cork agglomerate panels (0.065 $Wm^{-1}K^{-1}$), but a heat capacity definitely lower (350 $Jkg^{-1}K^{-1}$) than the average value of the specific capacity of agglomerate panels (3370 $Jkg^{-1}K^{-1}$) and a value of thermal diffusivity ($1.00 \cdot 10^{-6}$ m^2s^{-1}) one order of magnitude higher than the average of the cork agglomerate panels ($1.04 \cdot 10^{-7}$ m^2s^{-1}). As mentioned above, the thermal diffusivity value of an insulating material is one of the most important indicators of

its thermal resistance, since it measures heat propagation through a wall of a temperature field under non steady-state conditions.

4 Conclusions

In this study, a simple method was used to measure conductivity and specific heat capacity by simulating the transient situation which occurs under real life conditions in hot Mediterranean climate areas. These values are particularly important to choose and properly apply the insulating material considering the external environmental conditions, typical of the place where the building is located, and the internal environmental conditions that should be assured. Therefore, the method was applied to evaluate the thermal performances of panels of cork agglomerate, a material that is used for the thermal insulation of premises for the temperature-controlled storage of agri-food products because it is not toxic. The values obtained confirmed the good insulating characteristics of the granulate panels, which, in some respects, are even better than those of natural cork are. In particular, cork agglomerate panels have a lower commercial value because, in most cases, cork granulate is obtained from recycled material.

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Performance Evaluation of Agricultural Drainage Water Statistically – A Case Study

Mahmoud Nasr[1], Hoda Farouk Zahran[2]

[1]Sanitary Engineering Department, Faculty of Engineering, Alexandria University, P.O. Box 21544, Alexandria, Egypt, e-mail: mahmmoudsaid@gmail.com
[2]Plant Production Department, Arid Land Cultivation Research Institute, City of Scientific Researches and Technological Applications, Alexandria, Egypt, e-mail: hfzahran@gmail.com

Abstract. Agricultural drainage water could be a source of water for irrigation in Egypt. A case study of an agricultural drainage water near El- Dare region – Borg El Arab City Alexandria, Egypt. Some Physical and chemical parameters (pH, temp, TDS, DO, EC, Salinity, NO_3–N, Cl^-) were measured on site during seasons of 2014, 2015. By statistical analysis from Min, Max, range, mean, SD and median a performance evaluation for this agricultural drainage water resource performed. In Egypt, Water quality standards have been developed governing the treatment of agricultural drainage water. The guidelines aim at protecting the natural environment from wastewater – related pollution.

Keywords: Agricultural drainage water- drainage water reuses- Egyptian standards - water quality.

1 Introduction

Safe reuse and disposal of water requires an understanding of the characteristics of the drainage water (Nasr, 2015). Water quality is a description of biological, chemical, and physical characteristics of water (El Gohary, 2015). The water quality is normally assessed by measuring a broad range of parameters (e.g., temperature; pH; electrical conductivity (EC); turbidity; and the concentrations of a variety of pollutants, including pathogens, nutrients, organics, and metals) (Abdel Azim, 2000). In Egypt, water quality standards have been developed to govern the treatment of agricultural drainage water (El-Kady, 1999). The guidelines aim at protecting the natural environment from wastewater – related pollution. Those rules are illustrated in several articles and reports as follows (http://www.afdb.org; APRP, 1998; Drainage Research Institute, 1995; Egyptian Environmental Affairs Agency, 1992; EHCW, 1995) : Law 48/1982 Regarding the protection of the river Nile and waterways from pollution - Article 12: Conditions for drainage water reuse; Ministerial Decree 8/1983 on Law 48/1982 Concerning reuse of drainage water - Article 65: Standards for mixing drainage water with canal water (reuse) by the ministry of water resources and irrigation; Law 12/1982 Regarding the irrigation and drainage - Article 31: Specifications of the drainage water network established

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according to the ministry of water resources and irrigation - Article 48: Conditions for drainage water reuse in Irrigation purposes determined by the ministry of water resources and irrigation; Ministerial Decree 44/2000 Regarding the Amendment of Law 93/1962 on the drainage of liquid wastes - Article 15: Specification of the irrigated lands - criteria for types of plants for each type of wastewater treatment - environmental and health precautions.

2 Study area

Agricultural drainage water was near El- Dare region – Borg El Arab City Alexandria, Egypt.

3 Determination and Statistical Analysis of Samples' Data

Physical and chemical parameters (pH, Temperature [temp] , Total Dissolved Solids [TDS], Dissolved Oxygen [DO], Electrical Conductivity [EC], Salinity, Nitrate as Nitogen Concentration [NO_3–N], Chlorides [Cl^-]) were measured on site during seasons of 2014, 2015 using Multiparameter water quality probe- Aquaprobe® AP-7000, England according to Standard Methods for examination of Water and Wastewater (Eaton, 2005).

and next statistical analysis from minimum (Min), maximum (Max), range, mean, standard deviation(SD) and median (Walker, 2002) for data were performed as shown in table (1) and some formula for statistical calculations are shown in table (2).

Table 1. Statistical Analysis for Physical and Chemical Characteristics for Collected Samples

Parameters	Min	Max	Range	Mean	SD	Median
pH	7.90	10.30	2.40	8.70	0.90	8.30
Temp (°C)	18.50	21.90	3.40	20.30	1.00	20.10
TDS (ppm)	1.37	5.70	4.32	2.84	1.31	2.38
DO (%)	0.90	48.60	3.90	1. 40	1.00	1.20
EC µs/cm	2.05	9.00	6.95	4.18	2.13	3.46
Salinity (g/kg)	1.06	2.60	1.54	1.72	0.46	1.69
NO_3–N (mg/L)	0.01	0.55	0.36	0.39	0.11	0.39
Cl^- (mg/L)	14. 80	155.50	140.70	94.19	45.70	92.00

Table 2. Statistical Analysis Formula of Data.

Measure	Formula	Description
Mean	$\Sigma x/n$	Balance point
Median	n+1/2 Position	Middle value when ordered
Mode	None	Most frequent

4 Reuse of drainage water

- Official reuse: by capturing drainage flows in main drains and mixing them with main canal water at centralized mixing pump stations.
- Intermediate reuse: water in a branch drain can be captured when its water quality is appropriate. It can avoid unnecessary losses of branch drain water by using it before being connected to a highly polluted main drain.
- Unofficial reuse: is defined as farmer's direct reuse of drainage water without pre-permission from Ministry of Water Resources and Irrigation. It exists wherever canal water shortage is recorded; i.e. mainly at canal end.

5 Conclusions

Based on the drainage water quality analysis of the drain and the Egyptian standards for the drainage water reuse, it's concluded that water quality of the drain doesn't meet the standards for direct reuse in irrigation. Vegetables irrigated with such drainage water are not safe for human and animal consumption. Therefore, a remediation solution using physical, chemical and/or biological methods is recommended.

Acknowledgments. All acknowledgments are represented for any member from Plant Production Department, Arid Land Cultivation Research Institute, City of Scientific Researches and Technological Applications, Alexandria, Egypt, who helped in this work along its duration of time.

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Body Amino Acid Composition of Axillary seabream (*Pagellus acarne* R., 1827) Catched from Dardanelles (Canakkale, Turkey)

Alkan Öztekin[1], Bayram Kızılkaya[2], Alparslan Aslan[3], Kahraman Selvi[4], Sevdan Yılmaz[2], Olcay Hisar[5], Sebahattin Ergün[2]

[1]Department of Fisheries Engineering, Faculty of Marine Sciences and Technology, Çanakkale Onsekiz Mart University, Turkey, e-mail: alkanoztekin@comu.edu.tr
[2]Department of Aquaculture, Faculty of Marine Sciences and Technology, Çanakkale Onsekiz Mart University, Turkey
[3]Department of Marine Technology Engineering, Faculty of Marine Sciences and Technology, Çanakkale Onsekiz Mart University, Turkey
[4]Yenice Vocational Collage, Çanakkale Onsekiz Mart University, Turkey
[5]Department of Basic Science, Faculty of Marine Sciences and Technology, Çanakkale Onsekiz Mart University, Turkey

Abstract. Amino acid composition of the whole body tissue of Axillary seabream (*Pagellus acarne*) was determined. Fish was catched from Dardanelles (April 2013) via fishing line. The most abundant amino acid was Glutamic Acid (11.0 g/100 g crude protein) and Valine was the most abundant essential amino acid (6.2 g/100 g crude protein). The total essential amino acid content was 32.3 g/100 g crude protein and the total nonessential amino acid content was 42.5 g/100 g crude protein.

Keywords: *Pagellus acarne*, Axillary seabream, Dardanelles, Amino acid composition

1 Introduction

Axillary seabream is a sparid distributed in Eastern Atlantic and Mediterranean Sea, occurring from Bay of Biscay to Senegal, Cap Vert, the Azores, Madeira and the Canary Islands (AO CECAF Scientific Committee (AO CECAF Scientific Committee, 2007). This species is found on hard and sandy bottoms at depths ranging from 0 to 500 m, mainly between 40 - 100 m (Muus and Nielsen 1999; Bauchot and Hureau 1990). It is an hermaphrodite, omnivorous species, but prefer worms, mollusks and small crustaceans (Bauchot and Hureau 1990).

Fish is a important source of essential amino acids with growing evidence of potential benefits and fish consumption relate to the use of proteins of high biological value, as well as certain minerals and vitamins (Shaviklo et al 2015). On the other hand, the fish growth optimization is closely linked to the supply of dietary protein

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and it can be maximized by manipulating the composition of the dietary amino acid (Limin et al. 2006).

Although several fish species are cultured worldwide, data on the quantitative requirements for all the essential amino acids have been reported for only a limited number of fish (NRC, 1993). Axillary seabream is considered promising new fish species for marine aquaculture in Turkey (Guner et al 2013). However, its amino acid composition unknown.

The aim of the present study was to determine amino acid composition in territorially consumed Axillary seabream in Dardanelles.

2 Material and Method

Axillary seabream was caught from sampling station (Güzelyalı) in April 2013 in Dardanelles using a fishing line. All samples were collected in the daytime and stored in ice baths until they arrived in laboratory. The samples (n=10) were dried at 105 °C in an oven until they were of constant weight before use.

In order to determine amino acid profiles, the dried samples were hydrolyzed at 110^{o}C for 24 hours with 6.0 M hydrochloric acid. After evaporation, hydrolyzed samples were all dissolved in citrate–sodium citrate buffer (0.1 M, pH 2.2) (Chi al. 2008).

High performance liquid chromatography (HPLC) is generally used for the analysis of amino acid contents. O-Phthalaldehyde (OPA) is the important pre-column derivatization reagent by HPLC-Floresans Dedection or UV. The column and flow rate is a C18 reversed phase and 1.2 mL/min. Fluorimetrical detection of OPA derivatives is carried out at an Ex. 350 nm, Em. 450 nm for OPA derivatization. Mobile Phase consistent of phosphate buffer solution (pH 7.3, 0,02 M) (**A**) and ACN: MeOH: water (45:45:10, v/v/v) (**B**). The gradient elution system (**A/B**) is used as 90/10-3 min, 90/10-10 min,78/22-2 min, 72/28-9 min, 70/30-4 min, 35/65-7 min, 25/75-1 min, 0/100-1 min, 0/100-2min, 90/10-2 min. The derivatization reagents are 10 µL 3-Mercaptopropionic Acid in 10 mL Borate Buffer and 10 mg O-Phthalaldehyde in 5 mL Borate Buffer. Firstly, it is added 45 μL MPA + 25 μL + 10 μL sample at the derivatization procedure, and then mixed and waited for 1 min. Then, it is added 10 μL FMOC in the solution, and mixed and waited for 2 min. Finally, 10 μL of derivatizated amino acids is injected to HPLC.

3 Results

The amino acid data are expressed as g/100 g amino acids in Table 1. The most abundant amino acid was Glutamic Acid (11.0 g/100 g crude protein) and Valine was the most abundant essential amino acid (6.2 g/100 g crude protein). The total essential amino acid content was 32.3 g/100 g crude protein and the total nonessential amino acid content was 42.5 g/100 g crude protein.

4 Discussion

It is widely recognized that the specific requirement for amino acids should be determined in terms of optimum amount of dietary protein necessary for most efficient animal production (Kim and Lall 2000).

Table 1. Whole body amino acids (g/100 g crude protein) of Axillary seabream on dry weight

Essential Amino Acids (EAA)	
Histidine (HIS)	2.1±0.1
Isoleucine (ILE)	6.1±0.3
Leucine (LEU)	2.5±0.2
Lysine (LYS)4	1.1±0.4
Methionine (MET)	4.5±0.1
Phenylalanine (PHE)	5.1±0.2
Threonine (THR)	4.7±0.1
Valine (VAL)	6.2±0.1
Total	32.3
Nonessential Amino Acids (NEAA)	
Alanine (ALA)	6.4±0.1
Aspartic Acid (ASP)	8.4±0.1
Glutamic Acid (GLU)	11.0±0.4
Glycine (GLY)	4.9±0.2
Serine (SER)	4.4±0.1
Tyrosine (TYR)	2.1±0.1
Hydroxylysine (HLY)	1.1±0.1
Cystine (C-C)	4.2±0.2
Total	42.5

The results of present study show that Axillary seabream has a high content of Valine and Isoleucine which are essential amino acids. Valine is involved in many metabolic pathways and is considered indispensable for protein synthesis and optimal fish growth (Abidi and Khan 2004). In addition, isoleucine is a branched-

chain, amino acid needed in the body to produce certain biochemical compounds that help in energy production and together with the other two branched-chain amino acids promotes tissue building (Khan and Abidi 2007). In the present study, glutamic acid which is essential for cell proliferation was the most predominant among all the amino acids in Axillary seabream.

This study demonstrate that Axillary seabream is good source of amino acids.

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Precision Agriculture – Comparison and Evaluation of Innovative Very High Resolution (UAV) and LandSat Data

Antonis Kavvadias[1], Emmanouil Psomiadis[2], Maroulio Chanioti[3], Eleni Gala[1], Spyros Michas[1]

[1]En Agris LLC, Evias 3 15125, Maroussi, Greece, e-mail: info@enagris.gr
[2]Agricultural University of Athens, Laboratory of Mineralogy & Geology, Iera Odos 75, 118 55, Athens, Greece, e-mail: mpsomiadis@aua.gr
[3]Inforest Research o.c, Glaraki 10B, 11145, Athens, Greece, e-mail: mchanioti@inforest.gr

Abstract. The Precision Agriculture primarily involves the use of geospatial technology to map the spatial changes in plant and soil conditions of crops and their correlation with agricultural inputs such as water, fertilizer, etc., at a spatial basis. For the present study, the UAV eBee of SenseFly SA was used, in order to demonstrate the utility and effectiveness of these new airborne instruments in the observation of crops. Also, the corresponding free data of the satellite Landsat-8 was used for the comparison. As study area the crop fields of the Agricultural University of Athens in Aliartos, Viotia were chosen. The NDVI (Normalized Difference Vegetation Index) given from the UAV and the Satellite was calculated separately by two different Softwares. A comparison and evaluation of the indicators of the two Remote Sensing means carried out, in order to examine the effectiveness of the data received from the UAV camera.

Keywords: Precision Agriculture, UAV, LandSat-8, NDVI

1 Introduction

A few years ago the use of UAVs was not that widespread. In the last decade, however, there was a rapid evolution of technology led to the creation of more sophisticated UAVs. The improved cameras that can carry, offer information in the Visible, Near-Infrared and Thermal part of the electromagnetic spectrum and the improved software of processing of images have led to the increasing use of the UAVs in Precision Agriculture (Xiang & Tian 2011, Mesas-Carrascosa et al. 2014, Torres-Sánchez et al. 2014, Rokhmana 2015).

In this study the UAV eBee of SenseFly SA and the camera Canon S110 NIR were used. The Canon S110 NIR takes images in Visible-Green, Visible-Red and Near-Infrared part of the electromagnetic spectrum.

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As study area was chosen the area of Aliartos, which belongs to the Agricultural University of Athens and includes an agricultural land of 110 hectares, with wheats, oats, alfalfa and fallow or uncultivated land (Figure 1).

Also, the choice of OLI receiver data was performed because the Landsat satellite system constitutes one of the most tested, designed and reliable satellite systems, even though the spatial resolution of 30m which provides is not fully considered satisfactory for pixel to pixel comparison with the UAV sensor. Therefore an attempt was made to compare the tendency of change of important vegetation indices such as NDVI. The two recording systems of the Landsat-8 satellite and the UAV provide recordings in the red and near infrared range of the electromagnetic radiation so that it is possible to calculate the NDVI index.

Fig. 1. The crops of the Agricultural University of Athens in Aliartos, Viotia, Greece Google Earth image

2 Data

Normalized Difference Vegetation Index (NDVI)
Estimation of:

- General plant health condition
- Photosynthetic activity
- Possible deficiency of nutrients

$$NDVI = \frac{(NIR - Red)}{(NIR + Red)} \quad (1)$$

2.1 Satellite Images: Landsat-8 (OLI)

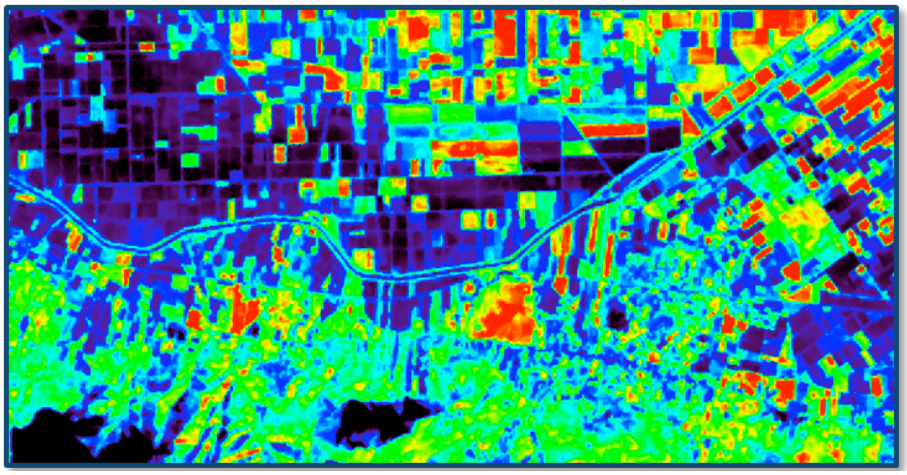

Fig. 2. Landsat-8 image of NDVI, Aliartos, 14/01/2015

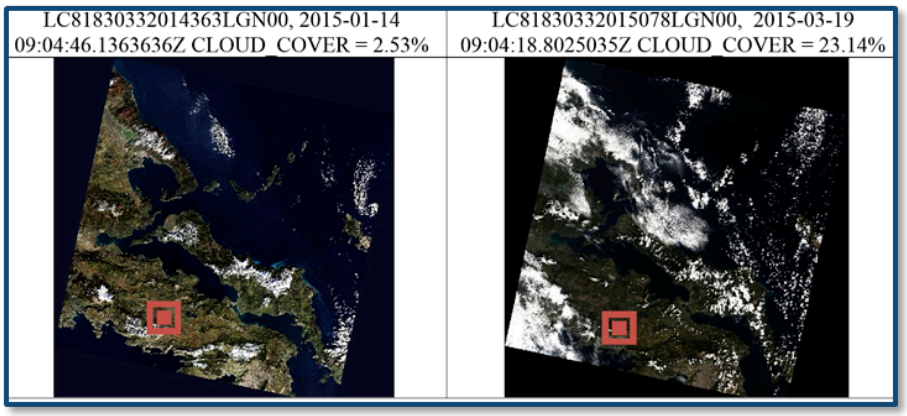

Fig. 3. The quicklooks of the Satellite images of Landsat-8 that were used

Table 1. The spectral bands of LandSat-8 that were used

Band	Wave Length (micrometers)	Resolution (meters)
Band 4 – Red	0.64 - 0.67	30
Band 5 - Near Infrared (NIR)	0.85 - 0.88	30
Band 8 – Panchromatic	0.50 - 0.68	15

2.2 UAV Images: EBee (Canon S110 NIR)

Platform: eBee
Gross Weight: 0.69 Kg
Wingspan: 96 cm
Max Flight Time: 45 min
Radio Link Range: 3 Km

Fig. 4. UAV Ebee

Sensor: Canon S110 NIR
Resolution: 12 MPixel
Bands:

- Green (G)
- Red (R)
- Near-infrared (NIR)

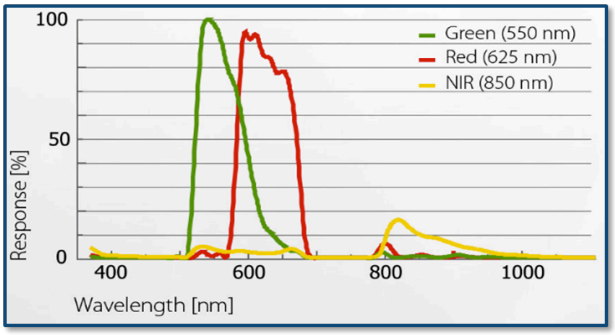

Fig. 5. The spectral ranges that the sensor Canon S110 NIR covers

Fig. 6. Wheat and Alfalfa crops, Aliartos. NIR image sample of eBee (Canon S110 NIR)

3 Methods

3.1 Landsat-8

- **Geometric Correction**
- **Atmospheric Correction** (ENVI, version 5.2)
  - Top of Atmosphere reflectance (ToA Reflectance)

Reflectance in the atmosphere

  - FLAASH (Fast Line-of-sight Atmospheric Analysis of Spectral Hypercubes)

Reflectance on the ground

- **Panchromatic sharpening**

(NNDiffuse PanSharpening, ENVI)

  - Panchromatic (Res: 15m)
  - Spectral Bands (Res: 30m → 15m)
- **NDVI export** (Res: 15m) (Fig. 7)

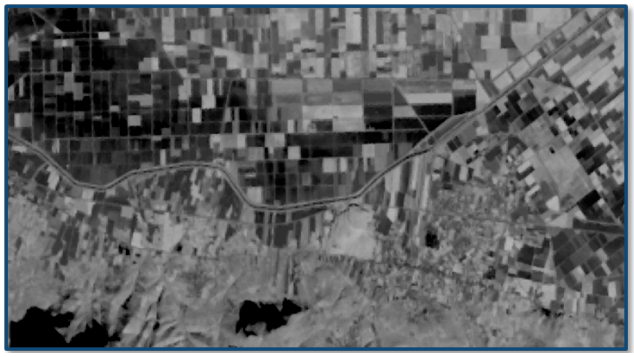

Fig. 7. Geometrically and Atmospherically corrected LandSat-8 image (Grayscale). Aliartos, 14/01/2015

3.2 UAV eBee

- **Flight Plans** (eMotion, SenseFly)
  - Image Resolution: 11cm/px
  - Lateral Overlap: 65%
  - Longitudinal Overlap: 80%

Flights

- Flight Duration: 25΄
- Flight Height: 315m

Image Post-process (PostflightTerra 3D, Pix4D)

- Orthomosaic production
- Reflectance Map production
- NDVI map production

Fig. 8. UAV flight control monitor

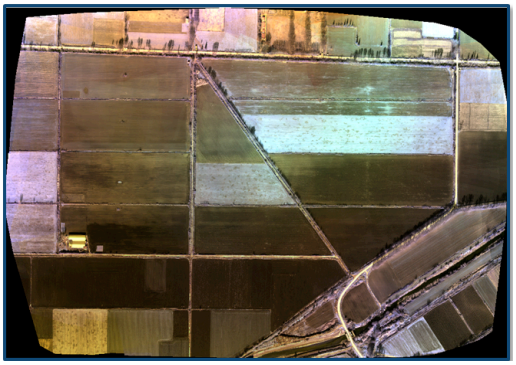

Fig. 9. Reflectance map of eBee. Aliartos, 14/01/2015

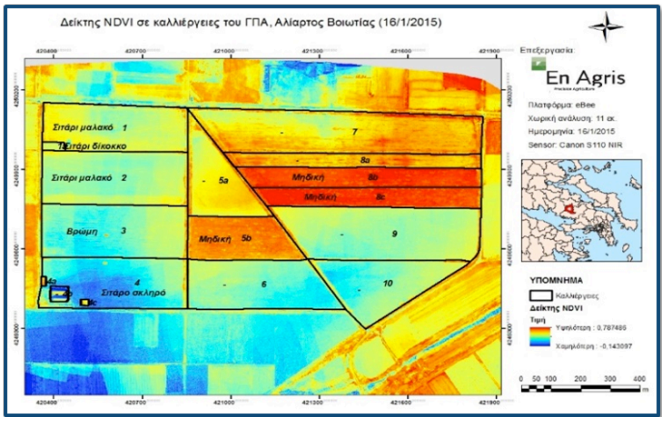

Fig. 10. NDVI Orthomosaic. Aliartos, 14/01/2015. Platform: eBee

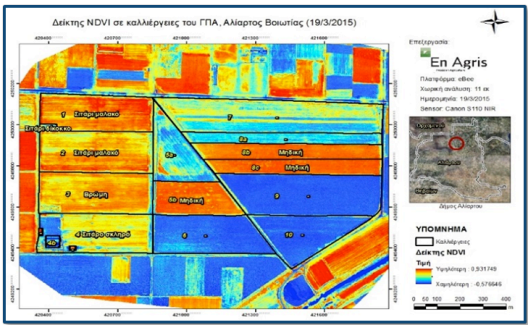

Fig. 11. NDVI Orthomosaic. Aliartos, 19/03/2015. Platform: eBee

4 Results – Discussion

The comparison of the NDVI values provided for the two periods (January and March) for each observation instrument (eBee and Landsat-8) carried out. Therefore we created a fishnet of values in such a way as to include any type of crop field. So the points 1-2-5 were selected in bare ground, the points 0-3-6 in fields that were sown in January and were grown in March (Soft wheat, Durum wheat and oats) and the points 4-7-8 in fields with different vegetation growth in each period (Alfalfa).

The NDVI values of the images were exported and reflected in a diagram for each period to a comparison of the trend of values for each observation instrument (Figure 13a and 13b). The comparison of the values in the diagrams showed a very good identification of the distribution (tendency) of the values for the two means of observation in both periods. Small deviations in some points, such as at point 0 in the diagram of January, are possibly due to the difference of spatial resolution between the images.

Also, in order to verify the given identification of the NDVI values between the two means of observation, a spatial profile of a linear section was created (Figure 14), so as to include, as many as possible different forms of vegetation; from bare soil to fields covered by full vegetation. The comparison of spatial profiles gave the same results to the charts and confirmed the very good identification of the distribution (tendency) of the values of the two means of observation in both periods (Figure 15).

4.1 Comparison of the tendency of NDVI values of the eBee & Landsat-8 for 14/01/2015 & 19/03/2015

4.1.1 Fishnet creation (0-8)

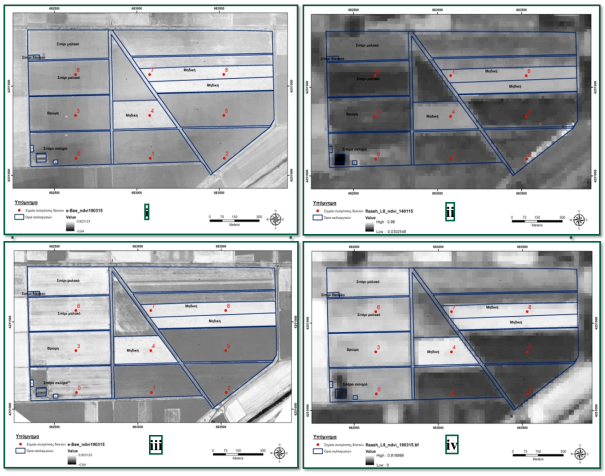

Fig. 12. The fishnet of selected points in the 4 maps; (i) eBee - January, (ii) Landsat_8 - January, (iii) eBee - March, and (iv) Landsat_8 – March

Table 2. The spectral bands of LandSat-8 that were used

Point	Cultivation
0	Durum Wheat
1	Bare Soil
2	Bare Soil
3	Oats
4	Alfalfa
5	Bare Soil
6	Soft Wheat
7	Alfalfa
8	Alfalfa

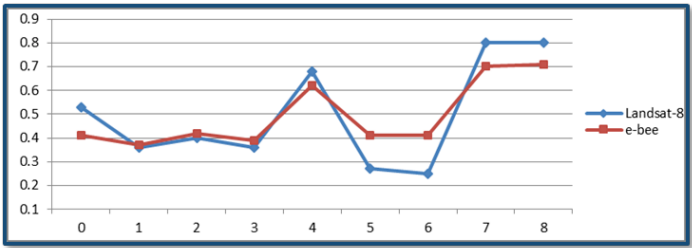

Fig. 13a. The NDVI values distribution of January, for the two means of observation

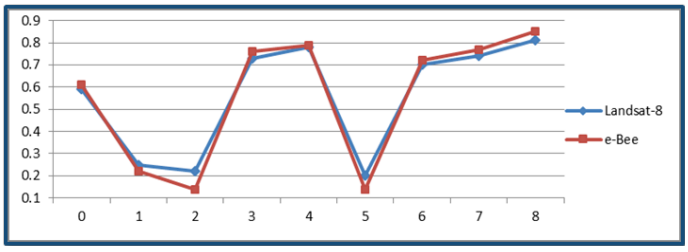

Fig. 13b. The NDVI values distribution of March, for the two means of observation

4.1.2 Linear section creation and spatial profile production for the NDVI maps

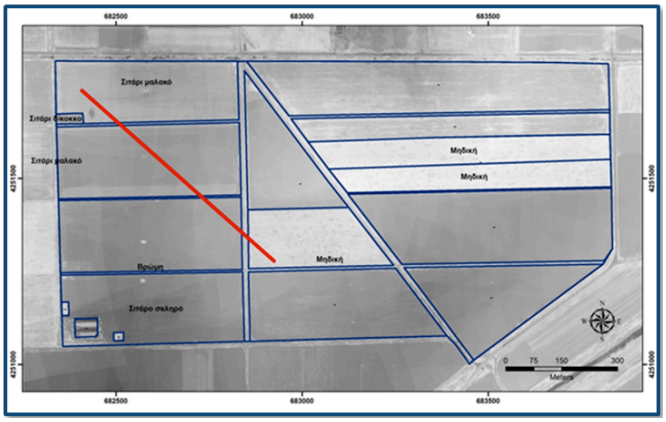

Fig. 14. The linear section (red line) that was chosen to create the spatial profile of the NDVI maps.

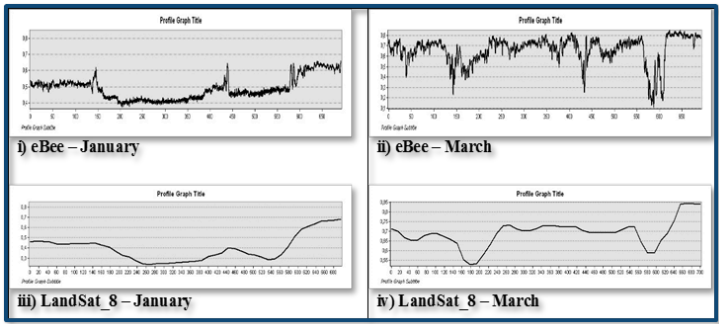

Fig. 15. The spatial profile of the linear section for the eBee (i, ii) and Landsat-8 (iii, iv) images for the January and March

5 Conclusion

The results of comparing the NDVI values of the two earth observation data have shown that there is a fairly good coincidence of the value variation between them, which demonstrates the excellent quality of the UAV data, while highlighting the usefulness for wider and more systematic use in Precision Agriculture. The UAVs as they offer a better spatial and temporal resolution, a higher speed and a lower cost, may offer more direct and easier solutions in agricultural production. Of course it is necessary and is a goal of further consideration in the near future, the comparison of the UAV with a remote sensing observational mean of a similar spatial resolution as well.

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Session 5: Wood Technology

Inferences on Wood Density Variability in European Ash Growing in Two Different Floodplain Forest Sites

Kyriaki Giagli[1], Jan Baar[2], Vladimír Gryc[2], Hanuš Vavrčík[2]

[1]Faculty of Forestry and Wood Technology, Mendel University in Brno, Zemědělská 3, 61300 Brno, Czech Republic, e-mail: giagli@node.mendelu.cz
[2]Faculty of Forestry and Wood Technology, Mendel University in Brno, Zemědělská 3, 61300 Brno, Czech Republic

Abstract. Wood density variations in 110-year-old European ash (*Fraxinus excelsior* L.) wood was examined in relation with different water regime treatments in two floodplain forest sites of similar elevation (Lednice 161 m a.s.l. and Tvrdonice 154 m a.s.l.) in South Moravia - Czech Republic, in order to infer on the oven-dry wood variability. Sample logs were obtained from breast height 1.3 m of the ground (log length 1 m) from 10 tree stems, i.e. 5 from each site. The oven-dry density was calculated along the radius of the stem cross section per tree and was compared between sites. The average oven-dry wood density of European ash was found significantly different for Lednice and Tvrdonice (689.8 kgm^{-3} and 665.1 kgm^{-3} respectively).

Keywords: floodplain forests; *Fraxinus excelsior* L.; oven-dry density; variability.

1 Introduction

European ash (*Fraxinus excelsior* L.) usually grows in mixed broadleaved forests as well as a groupwise admixture into oak, beech and alder stands (Dobrowolska et al. 2008). It also appears as a dominant species in floodplain forests and in moist clay-loam lowlands or even in relatively dry calcareous sites. This wide range of site types where European ash thrives, is attributed to a generally high tolerance in relation to water and nutrients (Střeštík and Šamonil 2006; Dobrowolska et al. 2011). Furthermore, it tolerates short-term flooding, although stagnant water is unfavorable for the species due to the limited oxygen supply. Vreugdenhil et al. (2006) reported intense negative effects of flooding on European ash growth.

European ash trees cover approximately 1.4 % of forest land areas in the Czech Republic (Ministry report 2014). The species commonly grows within the lowland belt which includes areas adjacent to large lowland rivers (below 210 m a.s.l.) covered mostly by floodplain forests, wetlands, inundated meadows, but also by sandy grasslands and saline habitats (Chytrý 2012).

European ash belongs to ring-porous hardwoods with a whitish to light brown sapwood and a dark brown heartwood, which is formed in older trees (Zeidler 2012). Aesthetically superior with outstanding wood properties (Dobrowolska et al. 2008), it

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produces a valuable raw material for wagons, boats and ships, furniture, parquet flooring, ladders, beams etc. (Tsoumis 1991).

Density is considered to be one of the most determinant wood characteristics, directly related with physical and mechanical properties (Tsoumis 1991). Wood density (or specific gravity) depends on the size of the cells, the cell-wall thickness, and moreover on the interrelationship between the number and the different types of cells (Panshin and de Zeeuw 1980). Wood density depends on the tree-ring structure i.e. earlywood and latewood. Considering that latewood consists of cells with thicker walls and smaller lumina in comparison to earlywood, the larger the latewood is, the higher the density becomes (Panshin and de Zeeuw 1980; Tsoumis 1991). According to the reported negative relation between the tree-ring width and the age, it is obvious that higher density is expected to appear in the central part of a tree stem of ring-porous species (Kollman 1951; Tsoumis 1991).

The average oven-dry wood density ranges from 650 to 687 kgm^{-3} for European ash (Kollman 1951; Matovič 1984). Kollman (1951) presented that European ash tree-ring width was narrow (less than 5 mm) by the first 10–15 years, becoming proportionally wider up to 40 years of age, whereupon it decreased continuously. Physical and mechanical properties of European ash also vary with the age, reaching the highest values by 30–40 years old. The difference between the wood density values measured in the center and the outer part of European ash stem was 22 % (Matovič 1984).

Variations in wood density are very important for wood industry (Taylor and Wooten 1973). These inferences can become a useful tool for estimating intra-species and inter-species wood variability in order to indicate representative density values for future tree selection projects. Finally, delineating the wood density profile is likely to improve the accuracy of stem biomass estimation.

The current study aimed to infer oven-dry wood variability in European ash (*Fraxinus excelsior* L.) growing in floodplain forest sites with different water regime treatments.

2 Materials and Methods

Two sites along the middle and lower course of the Morava river and lower courses of other rivers (Dyje) in southern Moravia in the Czech Republic were chosen for obtaining the sampling material. The first site (A) was a floodplain forest mixed stand of English oak and European ash (60 % of oak and 40 % of ash) in Lednice (161 m a. s. l.) and the second (B) was another floodplain forest mixed stand of similar mixture (70 % of oak and 30 % of ash) in Tvrdonice (154 m a.s.l.) (Fig. 1).

Floodplains of these rivers have been strongly modified by floods and associated accumulation of loamy sediments. The emergence of floods increased after the deforestation of sub-montane and montane areas occurred in the medieval period (Ložek 2011). Typically the rivers flood after snowmelt in March–April and occasionally after heavy rainfall, mostly during summer but also randomly during the year. The incidence of floods has declined during the last decades as a result of regulating the course of the rivers by diverting and deepening the riverbed, as well as

by constructing protective dikes (Prax et al. 2005). The site A was successfully regulated during '70s in order to lower the level of the water during floods. On the contrary, in the site B the water regime treatments were not successful enough to decrease the level. The mean annual temperature in the research area is 9.0–9.5°C and the annual precipitation amount is 500 mm (Chytrý 2012).

Five 110-year-old healthy European ash trees were selected randomly per site i.e. 10 trunks. Sample logs were obtained from breast height 1.3 m of the ground (log length 1 m). The mean diameter of the trunks ranged from 39.5 to 53.5 cm (site A) and from 44.0 to 56.5 cm (site B). Specimens 20 × 20 × 30 mm for oven-dry density testing were obtained radially from bark to pith (A – J) and prepared as shown on Fig. 1. The specimens were dried up to 0 % of moisture content in a program oven (at 103 ± 2˚C). Each oven-dried specimen was measured in three anatomical directions and specimens were weighed. Oven-dry wood density of specimens was calculated as:

$$\rho o = \frac{\mathrm{mo}}{\mathrm{Vo}}, \qquad (1)$$

where: m_0 – the oven-dry weight (kg)
V_0 – oven-dry volume (m^3)

R-program was used for statistical analysis (Students t-test, Tuckey's range test).

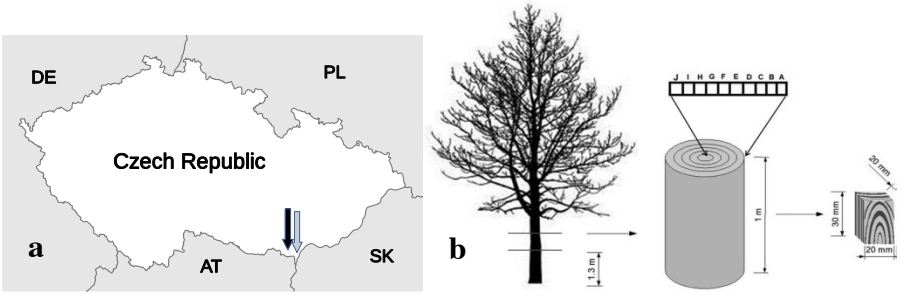

Fig. 1a. Sampling sites (Lednice-black arrow and Tvrdonice-grey arrow) in the Czech Republic, **b**. Sampling method.

3 Results and Discussion

The average oven-dry density of the specimens obtained from both sites (A and B) was found to be 677.3 kgm^{-3} (CV = 8.7 %), which is in line with the literature for European ash oven-dry density (Kollman 1951; Matovič 1984). Lexa et al. (1952) resulted to 680 kgm^{-3}, which was the closest to our finding.

The successful water regime treatment regulations in the site A resulted to a higher average oven-dry density in European ash, which was found to be in average 689.8 kgm^{-3} (CV = 8.9 %) and ranged from 495.4 to 814.2 kgm^{-3}. The average oven-

dry density of the specimens obtained from the site B was found lower (665.1 kgm^{-3}, CV = 8.2 %) ranging from 508.8 to 773.3 kgm^{-3} (Fig. 2a,c).

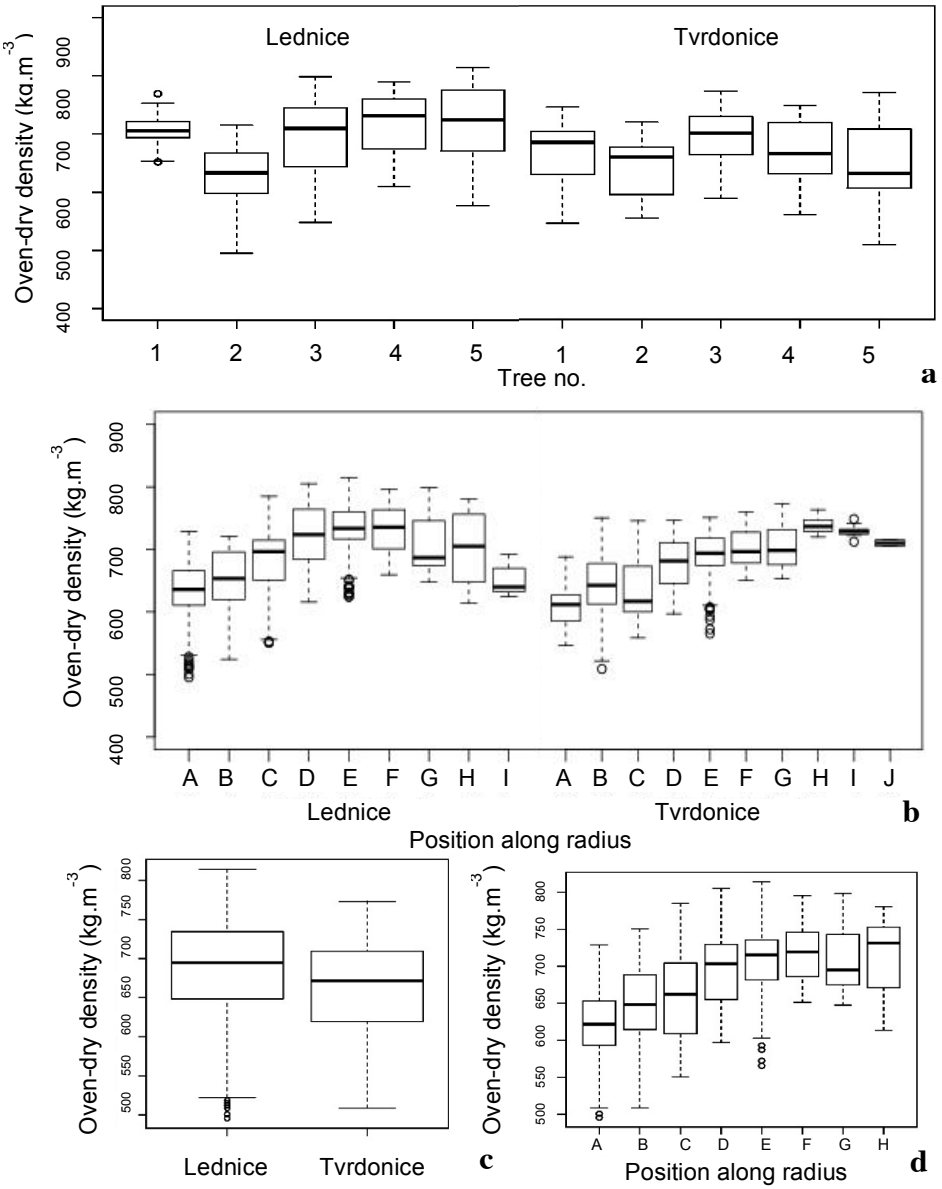

Fig. 2. a. Average oven-dry density per tree, **b.** Horizontal oven-dry wood density distribution, along radius from bark to pith (Lednice: A–I, Tvrdonice: A–J) per tree, **c.** Average oven-dry density per site, **d.** Horizontal oven-dry wood density distribution (both sites together).

The difference between the two sites was significant ($F = 1.3$, $p < 0.001$). The result of this study is in line with Matovič (1984) describing the negative relation between the oven-dry density of European ash wood and the level of the water during flooding.

The horizontal wood density variation analysis along radius (from bark to pith) differed significantly among the trees within the same or between two sites (Fig. 2b, d). In the site A, the highest average oven-dry density was found 732.6 kgm^{-3} (CV = 5 %) approximately 80 mm away from the pith (A–I), while in the site B, the highest average oven-dry density (739.3 kgm^{-3}, CV = 1.7 %) was located approximately 20 mm closer to the pith (A–I). Finally, in both sites (A + B) together, the highest average oven-dry density reached 718.0 kgm^{-3} (CV = 5 %), measured approximately 80 mm away from the pith. In all cases (A, B, A + B sites), the outer margins of the radial sections (close to bark and pith) presented significantly lower average oven-dry density than the central parts, which is in accordance with Matovič (1984). Furthermore, lower oven-dry density was observed to the specimens obtained closer to the bark in comparison with the samples that came from the parts closer to the pith, probably due to the sapwood area.

4 Conclusions

In this study, the highest average oven-dry density was found approximately 80 mm away from the pith. The margins of the radial sections (bark and pith) presented significantly lower average oven-dry density than the central parts in accordance also with Kollman 1951. Furthermore, in line with Matovič (1984), it was concluded during this research that the successful water regime treatment regulations in the site A resulted to a higher average oven-dry density in European ash.

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Techno-economic Analysis of Furniture Innovation: Developing a Green and Smart Furniture for Mass Production

Ioannis Papadopoulos[1], Marios Trigkas[2], Glykeria Karagouni[3], Emmanouil Dedoulis[4], Aikaterini Papadopoulou[5], George Blanas[6]

[1]Department of Wood & Furniture Design & Technology, Technology Educational Institute of Thessaly, 11 Str. Griva, Karditsa, 43100 Greece, e-mail: papad@teithessaly.gr
[2]Department of Forestry & Natural Environment Aristotle University of Thessaloniki, Building B Finikas Thessaloniki, 55134 Greece, e-mail: mtrigkas@for.auth.gr
[3]Department of Wood & Furniture Design & Technology, Technology Educational Institute of Thessaly, 11 Str. Griva, Karditsa, 43100 Greece, e-mail: karagg@teithessaly.gr
[4]Department of Business Administration, Athens University of Economics and Business, Greece, e-mail: ededoulis@aueb.gr
[5]Department of Business Administration, Athens University of Economics and Business, Greece, e-mail: fixipapad@hotmail.com
[6]Department of Business Administration, Technology Educational Institute of Thessaly, Larissa, 41110 Greece, e-mail: blanas@teithessaly.gr

Abstract. Innovation is considered fundamental for the survival and sustainability of furniture manufacturers in Greece and Europe at least. The paper presents a draft summary of the techno-economic analysis of a non-incremental furniture innovation called GSF as an acronym of green and smart furniture. It regards a smart and purely ecological main entrance furniture piece with incorporated intelligent functions, wood and recyclable materials and eco-based production process. Profit-loss analysis indicates that the new proposal may be successful if it exceeds the Greek market. Initially high costs of specific material and processes may be reconsidered if economies of scale are developed.

Keywords: techno-economic analysis, green and smart furniture, furniture innovation, furniture industry.

1 Introduction

Furniture manufacturing is a highly mature industry based on craft-method production serving primarily local and national markets. However, it constitutes a significant sector in the E.U. with a strong presence globally; European Union is still one of the biggest manufacturers, traders and consumers of wooden products in the world (European Commission, 2013). During the period 2000-2007, furniture industry has known significant growth; a series of global rearrangements of the sectoral players resulted in Asian producers to take the lead and big players to change

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the rules of the game. Furthermore, the crisis of 2008 and the continuing severe crisis in Greece intensify the rather negative and risky efforts of Greek furniture manufacturers to survive.

A number of studies (Petrakis et al., 2015; Trigkas et al., 2014, Kumar et al., 2013; Gibson and Naquin, 2013) indicate innovation and differentiation together with the development of extroversion as the only ways for these firms to stay active in the national and global markets. An emerging field for innovation regards the growing concern related to the environmental consequences either in regard of production and transportation or raw materials and the use and disposal of produced goods during their lifecycle (Fankhauser et al., 2013; Costantini and Mazzanti, 2012; Papadopoulos et al., 2010). Furthermore, technological advances and ICT applications offer the potential of novel concepts regarding comfort, usability and even production.

The GSF research project regards the development of a non-incremental innovation based on the combination of ICT and ecological production. Selecting the elderly as the main target group, research focused on the development and market introduction of technologically supported furniture eco-solution to foster the targeted consumers' self-determined living in their homes.

The research was undertaken by the Laboratory of Applied Marketing, Management and Economic of the Wood and Furniture Design and Technology Department of TEI of Thessaly Greece (WFDT from now on). The research team included an ICT company, a furniture small company, two other Universities and a number of external collaborators. The research project has been co-financed by the European Union (European Social Fund - ESF) and Greek national funds through the Operational Program "Education and Lifelong Learning" of the National Strategic Reference Framework (NSRF) - Research Funding Program "ARCHIMEDES III Investing in knowledge society through the European Social Fund".

2 Technological Analysis

The innovative furniture product regards an entrance furniture piece called "The heart" (Fig. 1). Its innovativeness lies in the incorporation of intelligent functions while the product is totally ecological. Although there is an increasing trend towards intelligent furniture as well as towards green furniture, it appears that the two trends were never combined. In addition, both trends are relatively new and seem to become stronger as the need of innovation in the sectors becomes more imperative.

The main characteristics of the "heart" are:

a) Natural wood as core material and more precisely, American oak solid wood of the best quality.
b) Recyclable supplementary material
c) The ICT system is composed of an Android tablet, a number of sensors and a PLC. JAVA was used in Eclipse environment using the Android Development Tools (ADT) which extends the IDE Eclipse for Android Projects development.

d) Functions: mirror becomes an information screen (e.g. face recognition, indications about clothing and accessories, reminder of pills or meals etc.)
e) Store room for small objects, documents (e.g. letters, medicine descriptions etc) in interaction with the supplied info by the mirror
f) Specific store room and relevant info on spectacle cases and keys
g) A wheelbarrow with store room attached (as part of the furniture) serving as a sitting or supporting facility or a medium to carry heavy (in terms of the elderly) load.
h) Supporting elements to hang objects (coats, hats, umbrellas etc) with sensors to remind use of them under certain conditions (e.g. an umbrella for the rain).

Design provided the potential to add or remove elements; it can adapt to specific individual needs enabling consumers to choose and buy the parts they needed. Furthermore, the screen can provide info-elements such as news and indications for close relatives and friends added in a friendly and easy way. It has further the basis for co-operation with other smart devices in a smart environment; i.e. inform on security issues.

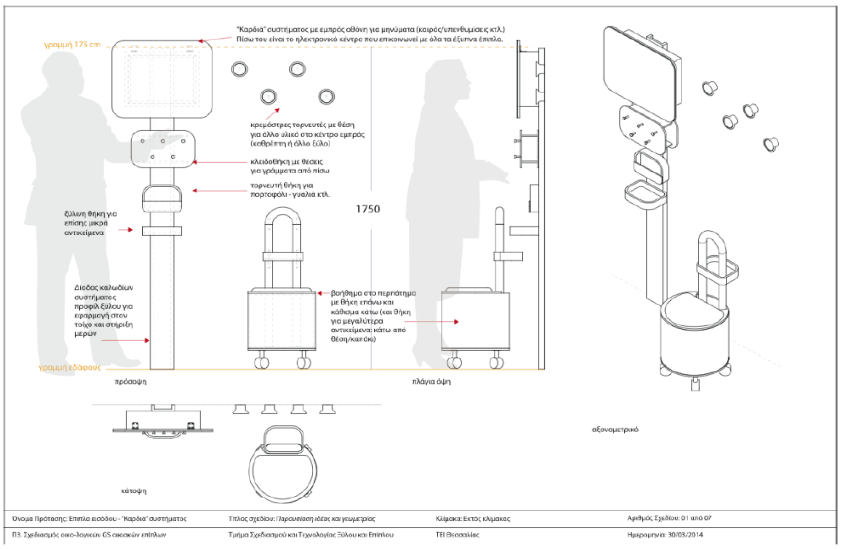

Fig. 1. The "heart" GSF product

The main wooden parts are the following:

- The basic profile
- The "heart" where the electronic parts are installed
- Store rooms for small objects
- The key ring and folder places
- Hangers (with sensors)

- The supporter (serves as shopping carrier, a seat and a kind of supporter for walking in the house)

The production of the wooden parts follows the normal production line shown in Figure 2. Parameterization of initial panel cutting eliminated waste, try-and-error efforts have eliminated energy needed while water is of minimum use. No measurements have been yet performed regarding CO_2 omissions.

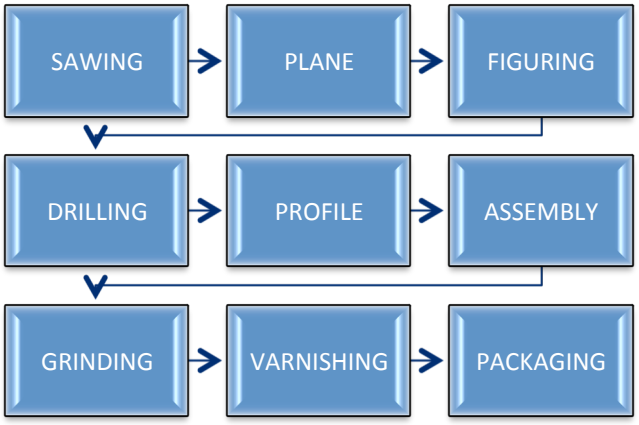

Fig. 2. Production process of wooden parts

The electronic parts have been chosen to be of recyclable material where possible, added to be "invisible" but easy to access in case of technical problem. All supplementary material was recyclable or recycled material. In regard of the ICT part, the system was composed of an Android tablet, a number of sensors and a PLC. JAVA was used in Eclipse environment using the Android Development Tools (ADT) which extends the IDE Eclipse for Android Projects development. Regarding face recognition, the open code OpenCV library was used. Advances in this area will be taken into consideration for improved or new editions of the furniture.

3 Economic analysis

Raw materials are subject to two core limitations; i.e. they have to be totally eco-materials, recycled or recyclable and be able to be assembled by eco-based ways.

Table 1. Cost of raw and supplementary materials per furniture piece

Raw materials	UNIT	Quantity	% loss	€/m^3	Cost (€)
Solid wood - oaks	m^3	0.02300	19	1,800	41.35
Glulum (Solid Wood Pannel)	m^3	0.00244	20	9,500	23.15
Plywood	m^3	0.00171	25	700	1.20
Supplementary material					75.25
Electronic Parts					845.7
Total					**986.65**

Therefore, the high cost, especially of the electronic parts, is due to the above specific limitations. On the other hand, elimination of energy consumption and the adaptation of conventional machinery, in order to secure the ecological production, have some impact on the total production costs. Costs are expected to fall in the future due to the development of economies of scale, the advances in the eco-production of electronic parts and automatization and the improvement of the suggested production technologies.

The estimation of marketing expenses in export markets is roughly estimated due to the significant unstable socio-economic environment and the positioning of Greece within the EU framework. Table 2 presents the total cost per piece and the suggested prices in Greece and the European market.

Table 2. Total costs per furniture piece

TYPES OF COSTS *(per piece)* (€)	**Greece**	**export**
Raw material	986.7	986.7
Labor cost	176.7	176.7
General Industrial Expenses	140.3	140.3
Packaging/ Distribution / Storage	39.1	78.2
Other costs	26.1	26.1
Total production cost	**1368.9**	**1408.0**
Marketing	261.1	322.00
TOTAL	**1630.0**	**1730.0**
Profit	**244.5**	**173.0**
Suggested prices in Euros including VAT (23%)	**1874.5**	**1903.0**

Prices can be considered high if compared to conventional relevant pieces of furniture. However, they are competitive if compared with high-value furniture (this can be due to design name or ecological value).

Marketing is considered of high importance since it regards the communication of values that combine quality of life to ecologic benefits and support a quite radical innovation. Especially in Greece, such products need to be widely discussed in order to reach a critical mass of consumers and become known. Europe's consumers may

be regarded more sensitive to eco-matters, more prone to information through internet and therefore marketing will not be much more costly than in Greece.

Table 3 presents the profit-loss analysis for the subsequent three years. The time period is considered satisfactory since it regards a radical novelty for the Greek market and it can be assumed among the innovative furniture products in Europe as well. However, estimations are quite moderated, mainly for the Greek market; this is due to the mediocre buying capacity of the third age population at this very moment due to the crisis and the political instability.

Table 3. Profit-loss analysis

SALES VOLUME (IN PIECES)	YEAR 1	YEAR 2	YEAR 3
Sales in Greece	170	190	210
Sales (exports)	400	440	490
SALES TOTAL	**570**	**630**	**700**
SALES (IN EUROS)	YEAR 1	YEAR 2	YEAR 3
Unit price in euros (Greece)	1875	1875	1875
Unit price in euros (Exports)	1903	1903	1903
Sales in Greece	318.750	356.250	393.750
Sales (exports)	760.000	836.000	931.000
SALES TOTAL	**1.078.750**	**1.192.250**	**1.324.750**
Cost of goods sold	812.877,9	898.443,9	998.271,1
GROSS PROFIT	265.872,1	293.806,1	326.479,0
EXPENSES			
Investment expenses (amortizations)	15,315.0	15,315.0	15,315.0
R&D expenses	53,937,5	59,612,5	66,237.5
Other expenses	4,146.2	3,418.0	2,642.4
Taxes	50,043.1	56,019.8	62,993.8
TOTAL EXPENSES	123,441.7	134,365.3	147,188.7
NET PROFIT (before taxes)	142,430.4	159,440.8	179,290.3

The increase in sales volume per year is also the most moderate for the same reasons. On the other hand, the moderate volume of exports is due mainly to two reasons:

a) the quite hostile current business environment in Greece that hinders export activity
b) the generalized suspicion towards Greek business today, taking into account the usual difficulties of foreign market entrance.

According to net profits per year as they appear in Table 3 and Figure 3, the innovative green and smart furniture has the potential to be profitable even under the most pessimistic expectations. Improvements that have already been planed will improve functionality and user-friendliness enhancing further the value of the new product.

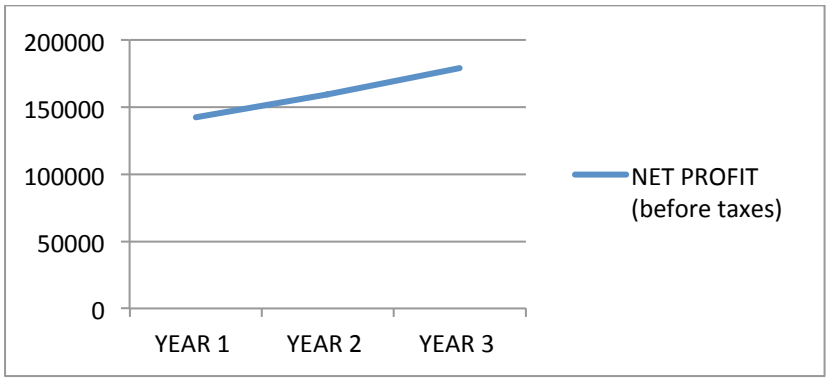

Fig. 3. Net profits (before taxes) in Euros for the first three years

4 Conclusions

The present paper presented the techno-economic analysis of an innovative piece of furniture that combine the ecological value with the information and communication technology novelties. The product is actually a main entrance intelligent furniture piece which addresses every day of the ordinary people and can suit perfectly to the needs of elderly for more self-dependence. However, it may serve other groups of consumers as well.

The development of a techno-economic analysis in the mature and craft-based furniture sector is quite a challenge; markets are quite suspicious against the benefits of intelligent furniture in general since it a just emerging market. On the other hand, ecological perspectives have been overestimated in the past, especially when combined with branded designer names and luxurious shows. Readers should also bear in mind that ICT technology is evolving at very fast paces which may alter the initial costs of the product. On the contrary the eco-production of the wooden and recyclable parts of the product is quite easy to cost. Moving from costs to sales' predictions, difficulties are easy to trace. Besides market analysis, the outline of consumers' attitudes for such products is still quite vague. Furthermore, the severe socio-economic and political crisis in Greece enhances the vulnerable and highly volatile business environment and markets.

Yet, the very moderate profit-loss analysis indicates success under the condition that the product will be simultaneously launched in Greek and European markets. Furthermore, seeing it under a wider perspective, innovation combined to

extroversion is proven to be fundamental for the survival and sustainability of furniture manufacturers in Greece at least.

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Attitude of Evros' s Farmers for the Genetically Modified Trees

Stavros Valsamidis[1], Ioannis Petasakis[2], Elpida Tenidou[3], Lambros Tsourgiannis[4]

[1]Department of Accounting and Finance, EMaTTech Institute of Technology, Kavala, Agios Loukas, 65 404, Kavala, Greece, e-mail: svalsam@teikav.edu.gr
[2]Department of Accounting and Finance, EMaTTech Institute of Technology, Kavala, Agios Loukas, 65 404, Kavala, Greece, e-mail: jpetasakis@hotmail.com
[3]Department of Accounting and Finance, EMaTTech Institute of Technology, Kavala, Agios Loukas, 65 404, Kavala, Greece, e-mail: elpida.tenidou@gmail.com
[4]Department of Accounting and Finance, EMaTTech Institute of Technology, Kavala, Agios Loukas, 65 404, Kavala, Greece, e-mail: ltsourgiannis@gmail.com

Abstract. Genetically modified trees are now one more expression of human intervention in nature. As for other people is a suicidal mood at the cost of profit maximization, for others is an inevitable trend for the survival of continuing growing world population that gathers several advantages, a survey of those directly involved in the primary sector, farmers, and deemed necessary. The implementation of this research includes the completion of 100 questionnaires from farmers in the region of Evros. Then, using the widely used Excel and SPSS software packages are processed research results with the discovery of useful correlations. The results show that in the region of Evros opinions of farmers who have negative attitude to the cultivation of genetically modified forest trees is much more (70) versus those with positive (30). Both trends express their concern on different characteristics, the systematic mapping of which is attempted in this work. The intension to cultivate genetically modified trees in relation to the demographic characteristics of the farmers, the farm size, the farm size and the type of cultivation are also investigated.

Keywords: Genetically Modified Forest Trees, Evros, Farmers, Analysis of attitudes.

1 Introduction

Biotechnology is characterized as the technology of biological processes using organisms, or parts of their processes for the manufacture or production of useful or commercially exploitable substances and to provide services for the benefit of man (Thieman and Palladino, 2008). According to the Convention on Biological Diversity, biotechnology is defined as any technological application uses biological systems, living organisms or

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their derivatives to create or modify products for specific use (Convention on Biological Diversity, 1992). This definition includes medical and industrial applications as well as the tools and techniques used in agriculture and food production (FAO, 2004). The term denotes a wide range of processes, from the use of earthworms for protein production by the production of human genes, such as growth hormone. In biotech products include pharmaceutical proteins, foods, detergents, etc., while a variety of applications including the services of waste water and waste as a medical diagnosis, or achievements of gene therapy (EuropaBio, 2012). Biotechnology today, builds on the achievements of modern molecular biology and uses a number of techniques, including genetic engineering (recombinant DNA), Methods and tissue engineered cell cultures on a large scale, the polymerase chain reaction, etc. It has numerous applications in health sciences, environmental protection (eg use in waste management), agriculture, livestock and industry. Together with biomedical technology, which the development of technologies with applications in medicine, biotechnology sometimes called *biological engineering* (Walter and Menzies, 2010). In fact the term biotechnology includes a broad set of tools and application of these tools. *Genetic engineering* only started in 1982 when (Palmiter et al., 1982) created the first genetically modified or otherwise *transgenic* mice. Genetic engineering may be new but the creation of new agencies with modified genetic material, can be done relatively quickly.

Agricultural biotechnology concerns mainly *Genetically Modified Trees (GMT)* and is particularly interesting since the first seeds of GM in America planted. The commercial sale of genetically modified food began in 1994, when Calgene brought first marketed the slow ripening tomato (Clive, 1996). According to the World Health Organization (WHO), Genetically Modified Trees are trees whose genetic material (DNA) has been altered in a way not found in nature. This technology is often called modern *biotechnology* or *gene technology* and sometimes recombinant DNA technology or genetic engineering (WHO, 2002). According to Sedjo (2004) a plant comprising introducing a gene using an approach beyond sex (nonsexual) considered bioengineered plant and designated as a transgenic. Among the various techniques used to generate transgenic plants, Agrobacterium transformation is the most widely used tool, representing 80% of the transgenic plants produced (Broothaerts et al., 2005). The term GM crops refer to crop plants created with the latest technologies used molecular biology and which plants intended for consumption by humans or animals. The modification is done in laboratory conditions and its goal usually is to support them in a desirable feature, for example resistance to herbicides or improved nutritional content (Varzakas et al., 2007a).

Over the last two decades there have been significant developments in biotechnological applications. The overall coverage in a survey (Sedjo, 2004) and the working paper (Preliminary review of biotechnology in forestry, 2004) present that the cultivation of GM foods and crops include dynamic technology, potential risks to public health and safety of ecosystems, powerful economic lobbies, impact on small surface areas and small farmers, nutritional promises and scandals, political strategies, European

directives and easy identification of citizens with actual or potential problems and injustices arising from their use. Furthermore, the use of GM forest trees in commercial plantations would contribute to increased forest productivity, improved pulp for paper, biofuel production, climate change mitigation, preservation of biodiversity and reduction of energy, pesticides and fertilizers utilization (Sedjo 2006, Chapotin and Wolt 2007, FAO 2008, 2010, Hinchee et al. 2009, Flachowsky et al. 2009, Harfouche et al. 2011). While these practices may perhaps increase profits for wood and paper products firms, the high economic, ecological and social costs associated with industrial tree plantations are paid by those living in and around large scale plantations and by society at large (Carman et al 2006).

The working group led by Professor Athanasios Tsaftaris (2004), the former Minister for Rural Development and Food, among other findings, discovers a reluctance of Central Macedonia farmers in dealing with the agro-biotechnologies. The Greeks generally have negative attitudes towards the cultivation and consumption of GM trees and products, and there seems to be consensus among politicians and citizens in their opposition to genetically modified (Kousis, 2009). Greece has, so far, chosen the cultivation of GM trees mainly because of the small agricultural clergy, the geomorphological features, different microclimates and soil conditions favor the biological and integrated crop (Varzakas et al., 2007b).

Furthermore, the application of GM technologies to trees has raised a number of potential public concerns. Many of these concerns, although not all, are the same raised for GM annual crop plants, including the potential for spread of antibiotic or herbicide resistance genes to other non-target species from GM trees; the potential for long – distance pollen spread over many years from long – lived trees, the potential for adverse effects on biodiversity from forests of GM trees; and any unexpected effects (Gartland et al 2003).e

Public acceptance in particular is influenced by environmental, public health and socio-cultural concerns, which have been raised mainly by opinion influencing groups. Concerns often focus on potential genetic flow between GM and wild trees and consequent implications for the natural environment, increased use of broad spectrum herbicides, more pesticide resistant forest trees, negative effects on forest tree fitness, potential higher vulnerability of forest trees to viral and other diseases, increased soil decomposition, adverse effects on biotrophic processes in host ecosystems, flowering suppression and cultural adaptation to altered biodiversity conditions due to transgene escape (El- Lakany 2004,Van Frankenhuyzen and Beardmore 2004, Williams 2006, Sedjo 2006, Farnum et al. 2007, FAO 2008, 2010). In the Eurobarometer survey, (European Community, 2010) becomes apparent the opposition of the Greeks towards GM crops. While a small, relatively, a majority of Europeans (54%) believes that genetically modified foods are not good for them and their families, in Greece the percentage of those who oppose reaches 78%. The Greeks, in 89%, believe that it is fundamentally unnatural. Furthermore, 85% expressed huge concerns on security issues. As the former Minister of Rural Development and Food as Professor of Genetics and

Biotechnology at AUTH, expressed concern for possible adoption of personal views in formulating national agricultural policy (Journal Ling, 2012). On the other hand, according to Tsourgiannis *et. al*. (2013), (2014), (2015a), (2015b) it appears that there might be potential buyers of products derived from GM trees and more particular for wood products, woody biomass energy products and paper products originating from transgenic plantations in Greece. Indeed, most of these potential consumers willing to purchase transgenic wood products base their buying decisions on economic issues (Tsourgiannis *et. al*. 2013, 2014, 2015a, 2015b). Taking into consideration that most of these products are not directly linked with human health impacts, there is a potential for development of a market for such products, particularly in current times of economic depression.

The Peter Coventry (2001) argued that the Forest Council in the US should allow the certification of GM tree plantations as "well managed" by the effects of GM trees with reduced lignin in soils in relation to the physical produced. The Zolotov (2003) mentions the success of GM maize crops in the United States and expresses concern about the low rates of crops in Europe. Despite initial skepticism about whether biotechnology in forestry can also be related to environmental issues, including the effects on organisms associated with tree living and ecosystems, are presented and benefits from genetic modification of lignin (Axelsson et al., 2010). The reasons for not widespread commercial use of biotechnology research presented in 90 specific US (Strauss et al., 2009).

The transgenic biotechnology can help the forest improvement programs, but can also simultaneously be of concern for the safety of the environment. Today there is an urgent need to establish a European platform to build on this knowledge of GMT (Gallardo et al., 2011). Due to the negative public opinion about the GMT, the Strif and Broshe (2001) proposed to focus the efforts of the whole enterprise in producing trees which are not intended for consumption by humans or animals. For example, crops for the manufacture of fibers such as cotton or flax.

Developments in the field of GMT in plant industry have led to increased crop production and yield in turn have increased the use of genetically modified (GM) foods in the human food chain. The use of genetically modified foods for human consumption has raised a number of fundamental issues such as the ability of genetically modified foods cause potentially harmful immunological side effects like allergic hypersensitivity (Prescott and Hogan, 2006). Kuiper and Kleter (2003) do compare the safety of conventional food with respect to genetically modified food.

Interesting aspects about genetically modified trees in forests, are the ethical considerations (Gamborg and Sandoe, 2010), the relevant environmental concerns in forests (Fladung et al., 2010), social, legal and regulatory issues related to genetically modified plants (Sedjo, 2010).

The paper is organized as follows. Section 2 describes the approach. Section 3 describes the results for both descriptive statistics and advanced analysis. Section 4 presents discussion about the results together with directions in the future.

2 Approach

This study proposes an approach for analyzing the attitudes of farmers in the region of Evros regarding the Genetically Modified Trees. The research method used was simple random sampling. Information was recorded following an interview with each farmer individually.

The questionnaire consists of three parts. The first part comprises three farmers' attitude questions regarding Genetically Modified Forest Trees with analytical control of many individual factors. The second part includes the recording demographics of farmers. Finally the third part includes the recording of operating data for each of 100 farmers.

The questionnaire includes mainly qualitative data that is data stored in non-numeric form in contrast to quantitative data that are in numerical form. The quality is the data that describe the characteristics or properties held by an object (Strauss and Corbin, 1998). The properties are categorized into classes that can then be assigned a numerical value. There is no significance to these data values, simply object characteristics. In some areas of social research, the distinction between qualitative-quantitative data has led to prolonged disputes where each group supports the superiority of its own data type (Trochim and Donnelly, 2006). The 'quantitative' claim that their data is strictly reliable and scientifically while 'quality' that their are respectively sensitive, detailed and contextual.

Therefore, we suggest the following assumptions:

H1: The cultivation intention is related to the gender of the farmer.
H2: The cultivation intention is related to the age of the farmer.
H3: The cultivation intention is related to the level of education.
H4: The cultivation intention is related to the farm size.
H5: The cultivation intention is related to the type of cultivation.

The analysis performed includes both descriptive statistics and advanced analysis using X^2 test.

3 Results

Here are the results after data processing in Excel software packages 2007 and SPSS 18.0.

3.1 Descriptive Analysis

The sample is 100 farmers in the region of Evros, in the North East Greece. 55 of them are male and 45 are women. 65 are married and for 65 of them farming is their main occupation.

Table 1. Distribution of the sample based on the knowledge of the term GMT.

Knowledge of the term	Number	Percentage
Know	100	100,0

Table 2. Distribution of the sample by the intention of cultivation.

Cultivation intention	Number	Percentage
No	70	70,0
Yes	30	30,0
Total	100	100,0

Table 3. Distribution of the sample by age.

Age	Number	Percentage
20-29	35	35,0
30-44	25	25,0
45-64	35	35,0
65+	5	5,0
Total	100	100,0

60% of the farmers in the sample are younger than 44 years old.

Table 4. Distribution of the sample based on educational level

Education	Number	Percentage
Primary school	25	25,0
Secondary school	15	15,0
High School	40	40,0
University	20	20,0
Master / Doctorate	0	0,0
Total	100	100,0

The distribution of the sample based on educational level is presented at table 4. 80% has graduated in High school or lower and only 20% are graduates of university.

Table 5. Distribution of the sample based on the number of children

Number of children	Number	Percentage
None	30	30,0
1-2 kids	60	60,0
3+ Children	10	10,0
Total	100	100,0

Table 6. Distribution of the sample by age of child

Age of children	Number	Percentage
No children	35	35,0
Small children (0-12 years)	15	15,0
In adolescents (13-18 years)	15	15,0
Large (18+ years)	35	35,0
Total	100	100,0

Table 7. Distribution of the sample by farm size

Farm size	Number	Percentage
<10 acres	25	25,0
11-50 acres	15	15,0
51-100 acres	10	10,0
101-200 acres	50	50,0
Total	100	100,0

Table 8. Distribution of sample by type of cultivation

Type of crop	Number	Percentage
Arable	15	15,0
Vegetables	35	35,0
Orchards	10	10,0
Groves	10	10,0
Forest plantations	30	30,0
Other	0	0,0
Total	100	100,0

3.2 Advanced Analysis

The results of the Chi-Square test regarding the hypotheses of section 2, are presented in this subsection.

Table 9. Cultivation intention in relation to gender

Cultivation of GMT	Female	Male	Total
No	30	40	70
Yes	15	15	30
Total	45	55	100

There is no dependence to gender (value of Pearson Chi-Square= is 0.433, df=1, p-value=0.511).

Table 10. Cultivation intention in relation to age

Cultivation of GMT	Age				Total
	20-29	30-44	45-64	65+	
No	20	10	35	5	70
Yes	15	15	0	0	30
Total	35	25	35	5	100

There is dependence to age (value of Pearson Chi-Square= is 30.612, df=3, p-value<0.001). Younger farmers are less negative to the cultivation of GM forest trees.

Table 11. Cultivation of GMTs in relation to level of education

Would you cultivate GMTs?	Level of education				Total
	Primary school	Secondary school	High School	University	
No	25	10	20	15	70
Yes	0	5	20	5	30
Total	25	15	40	20	100

There is dependence to level of education (value of Pearson Chi-Square= is 18.651, df=3, p-value<0.001). It is worth to notice that farmers with basic education and university graduates are the most negative to the cultivation of GMT.

Table 12. Cultivation of GMTs in relation to farm size

Would you cultivate GMTs?	Farm size				Total
	<=10 acres	11-50 acres	51-100 acres	101-200 acres	
No	5	10	10	45	70
Yes	20	5	0	5	30
Total	25	15	10	50	100

There is dependence to the farm size (value of Pearson Chi-Square= is 43.651, df=3, p-value<0.001). Farmers who own less or equal to 10 acres, responded that would cultivate GMT in 80%.

Table 13. Cultivation of GMTs in relation to the type of cultivation

Would you cultivate GMTs?	Type of cultivation (crop)					Total
	Arable	Vegetables	Orchards	Groves	Forest plantations	
No	5	20	10	5	30	70
Yes	10	15	0	5	0	30
Total	15	35	10	10	30	100

There is dependence to the type of cultivation (value of Pearson Chi-Square= is 31.406, df=4, p-value<0.001). Farmers. Farmers who cultivate arable and vegetables are these who mostly would accept the cultivation of GMTs.

Table 14. Distribution of cultivation factors in median and percentile points (quartiles)

Factor	25%	Median	75%	Cronbach's Alpha
Q2a	2,50	3,50	4,00	
Q2b	1,00	3,50	4,00	
Q2c	1,00	3,50	5,00	
Q2d	1,75	3,00	3,00	
Q2e	1,00	2,50	3,00	0.854
Q2f	1,00	2,00	3,25	
Q2g	1,00	1,00	2,00	
Q2h	1,00	1,00	1,25	
Q2i	1,00	1,00	1,00	

The Cronbach's Alpha value is 0.854.

We create a new variable which is the average value of all factors of table 15. Its mean value is 2.17 (standard deviation 0.69).

Table 15. Relation of cultivation with gender

	gender	N	Mean
cultivation	Female	15	2,5926
	Male	15	1,7407

Males seem to be more positive about cultivation compared to Females (t=4.271, df=14, p-value=0.001).

Table 16. Relation of cultivation with type of cultivation

	N	Mean	Std. Deviation	95% Confidence Interval for Mean Lower Bound	Upper Bound
Arable	5	1,8889	,00000	1,8889	1,8889
Vegetables	20	2,3056	,25964	2,1840	2,4271
Orchards	10	3,1667	,99553	2,4545	3,8788
Forest plantations	30	2,6667	,00000	2,6667	2,6667
Other	70	2,4444	,89224	2,1113	2,7776
Total	70	2,4841	,76678	2,3013	2,6670

The willingness of farmers not to cultivate genetically modified products depends on the type of crop ($F_{4,65} = 3.555$, $p = 0.011$). Those with orchards are on average from 0.13 to 2.4 higher willingness not to cultivate genetically modified compared with those with arable (p-value = 0.018). Similarly those who have Orchards have, on average, from 0.1 to 1.7 higher willingness to cultivate non-GM compared to those with Vegetables (p-value = 0.0028).

Table 17. Relation of cultivation with farm size

	N	Mean	Std. Deviation	95% Confidence Interval for Mean Lower Bound	Upper Bound
<10 acres	5	2,5556	,00000	2,5556	2,5556
11-50 acres	10	3,3333	,81985	2,7468	3,9198
51-100 acres	10	2,4444	,35136	2,1931	2,6958
101-200 acres	45	2,2963	,74724	2,0718	2,5208
Total	70	2,4841	,76678	2,3013	2,6670

The willingness of farmers not to cultivate genetically modified products depends on the farm size ($F_{3,66} = 6.130$, $p = 0.001$). Those who have croplands from 11 to 50 acres have, on average from 0.04 to 1.7 units, higher willingness not to cultivate genetically modified comparatively with those who have from 51 to 100 acres (p-value = 0.033). Similarly those who have croplands from 11 to 50 acres have, on average from 0.4 to 1.7, higher willingness not to cultivate genetically modified comparatively with those who have from 101 to 200 acres (p-value = 0.001).

Table 18. Distribution of non cultivation factors in median and percentile points (quartiles)

Factor	25%	Median	75%	Cronbach's Alpha
Q2p	2,50	4,00	5,00	
Q2q	1,00	1,00	2,00	
Q2r	1,75	2,50	3,25	
Q2s	1,00	2,00	3,25	
Q2t	2,00	3,00	4,00	0.820
Q2u	1,00	3,00	3,25	
Q2v	1,75	3,00	4,00	
Q2w	1,00	3,00	3,25	
Q2x	1,00	1,00	1,00	

The Cronbach's Alpha value is 0.820. We create a new variable which is the average value of all factors of table 18. Its mean value is 2.48 (standard deviation 0.77).

Table 19. Relation of type gender with the possitiveness about non cultivation

	q4a	N	Mean	Std. Deviation
q2second	Female	30	2,6852	,70399
	Male	40	2,3333	,78567

Males and females does not differ according to possitiveness about non cultivation compared to Females. ($t=1.937$, $df=68$, p-value=0.057)

Table 20. Relation of type of cultivation with the willingness of farmers to cultivate GMT

	N	Mean	95% Confidence Interval for Mean	
			Lower Bound	Upper Bound
Arable	10	2,6667	2,5829	2,7505
Vegetables	15	2,1481	1,7648	2,5315
Forest Plantations	5	1,2222	1,2222	1,2222
Total	30	2,1667	1,9091	2,4242

The willingness of farmers to cultivate genetically modified products depends on the type of crop (F2.27 = 13.764, p = 0.001). Those who cultivate arable are on average from 0.7 to 2.1 higher willingness to cultivate genetically modified compared with those who cultivate forest plantations (p-value = 0.001). Similarly those who cultivate vegetables are on average from 0.3 to 1.5 higher willingness to cultivate genetically modified compared with those who have forest plantations (p-value = 0.001).

Table 21. Distribution of attitude factors vs the use of biotechnology (quartiles)

Factor	25%	Median	75%	Cronbach's Alpha
Q3a	2,00	2,50	4,00	
Q3b	1,00	3,00	4,00	
Q3c	2,00	3,00	3,75	
Q3d	1,00	3,00	3,00	
Q3e	2,25	3,50	4,00	
Q3f	3,25	4,00	5,00	0.915
Q3g	1,00	5,00	5,00	
Q3h	4,00	5,00	5,00	
Q3i	3,25	5,00	5,00	
Q3j	1,00	3,00	3,00	
Q3k	1,00	3,00	3,75	

4 Discussion and Conclusions

The aim of this study was to investigate the attitudes of farmers regarding the GMT. From the beginning there was the limitation of the number of responses. All the responders come from the same area (Evros). So possible generalized conclusions would be unreliable.

Nevertheless the value of the study in precious as it is the first study in Greece which examines the farmers attitudes towards the use of biotechnology in forest tree sector. In this research confirmed the continued negative attitude of the majority of farmers in relation to the cultivation of GMT, which has been recorded by the relevant survey reports Eurobarometer (European Commission - EC, 2010). In general, elder people with low education, mainly female, with large scale farms seems not to be in favour of cultivating transgenic trees whilst most of the younger, high educated, mainly male, small scale farmers are more positive towards the cultivation of GM trees.

In a constantly changing world, the persistence of the established notions of the past creates rigidities and barriers to future challenges. On the other hand the respect of values and tradition is essential for any organization. Somewhere there must be "balance" one for cultivation or not GMT.

According to Mc Donell et al (2010), the current decade will be important for researchers of trees. Conducting such research could contribute to better information on a subject that for others considered "taboo" and other necessary development. Furthermore the potential developers of such forest tree plantations and paper, wood and woody biomass energy products should structure their marketing and promotion according to the farmers profile that this study developed. Additionally a campaign that will aim to inform public about the use of biotechnology in forest tree sector and its advantages and disadvantages should take place.

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Environmental Viewpoint of Fuelwood Management

Grigorios L. Kyriakopoulos[1], Miltiadis S. Chalikias[2], Olga Kalaitzidou[3], Michalis Skordoulis[4], Dimitris Drosos[5]

[1]School of Electrical and Computer Engineering, Electric Power Division, National Technical University of Athens, Greece, e-mail: gregkyr@chemeng.ntua.gr
[2]Department of Business Administration, Piraeus University of Applied Sciences, Egaleo, Greece, e-mail: mchalik@teipir.gr
[3]Department of Mathematics, Aristotle University of Thessaloniki, Greece, e-mail: kalaitzidou.olga@gmail.com
[4]Department of Business Administration, University of Piraeus, Greece, e-mail: mskordoulis@gmail.com
[5]Department of Business Administration, Piraeus University of Applied Sciences, Egaleo, Greece, e-mail: drososd@teipir.gr

Abstract. The introduction of fuelwood production into the regional patterns of energy production and consumption is controversial and imperative. Subsequently, the global policies upon sustainable use of fuelwood necessitate an integrated and systematic coordination upon environmental and anthropogenic issues. This study provides a literature overview upon the environmental perspectives of forestry management, while focusing on an overview upon the environmental features of a contemporary fuelwood market. Conclusively, the study reiterates the determining issues of foodwood management, signifying those issues that determine the environmental perspective of a contemporary fuelwood market.

Keywords: environmental sustainability; forest protection; forestry management; fuelwood prosperity; renewables.

1 Introduction

Nowadays, there exists a large-scale utilization of land and water resources that intensifies the local environments threatening. Particularly, 30% of the earth's land is used for crops and pastures, and 70% of all abstracted freshwater is directed towards irrigation, aiming to produce a stable food supply for people and livestock. In parallel, excessive and indiscriminate use of fertilizers –mainly derivatives of phosphorous and nitrogen and other chemicals in agriculture– are burdening the pollution of air, water, and soils, putting at risk both pristine terrestrial and marine ecosystems downstream, as well as human health (Food and Agriculture Organization of the United Nations, 2013).

A literature overview within the last three decades of analysis revealed that Asian countries are among the most well-investigated regions upon the issues of fuelwood

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policies (Gazull and Gautier, 2015), fuelwood exploitation for heating purposes – mainly in third world (Zafeiriou et.al., 2011; Arabatzis et.al., 2012; Arabatzis and Malesios, 2013; Arabatzis et.al., 2013), endemic and exotic forestry species taxonomy/characteristics/chemical composition, as well as wood biomass yields, in the main socio-economic conditions (Specht et.al., 2015) and environmental perspectives (He et.al., 2009; Wang et.al., 2012). Moreover, there are abundant studies regarding the India context (Goel and Behl, 1996; Goel and Behl, 1995; Dunkerley et.al., 1990; Maikhuri, 1991; Bhatt et.al., 1994; Jain, 1994; Jain, 1993; Amatya et.al., 1993; Negi and Todaria, 1993; Jain, 1992; Garg, 1992).

In a worldwide context, fuelwood policies have been focused on forestry management upon energy production. Particularly, most biofuels are used for residential cooking and heating, mainly in Africa, Asia and Latin America. It is noteworthy that almost 90% of the wood removals in Africa are used for fuel. In countries that form the Organization for Economic Co-operation and Development (OECD), in many developed countries –such as Austria, Finland, Germany, and Sweden– biofuels are increasingly used for the production of electricity, attracting huge investments in wood-energy industries (International Energy Agency, 2005). Moreover, in the United States about 3% of energy demands are supplied by biomass. Much of this is exploited by the paper and pulp industry, which burns large quantities of fuelwood and paper milling wastes to supply energy for its needs. Other substantial consumers of forestry biomass include households that burn fuelwood as a primary source of heat (about 5% fall into this category) and another 20% occasionally burn fuelwood in a stove or fireplace), commercial industries and establishments that burn fuelwood as a source of energy. Such indicative energy uses from fuelwood feedstock are for space-heating purposes and for waste-to-energy facilities that burn municipal solid waste.

Additionally, outlook studies by the International Energy Agency indicate that renewable energy sources will continue to increase their market shares in the energy mix (International Energy Agency, 2005). While heating and cooking will remain the principal uses for fuelwood and charcoal in developing countries, the use of solid biofuels for the production of electricity is expected to triple by 2030 (International Energy Agency, 2005).

In the following Figure 1 the forest profile and characteristics –in a worldwide context– is presented for the reference year 2010, accordingly.

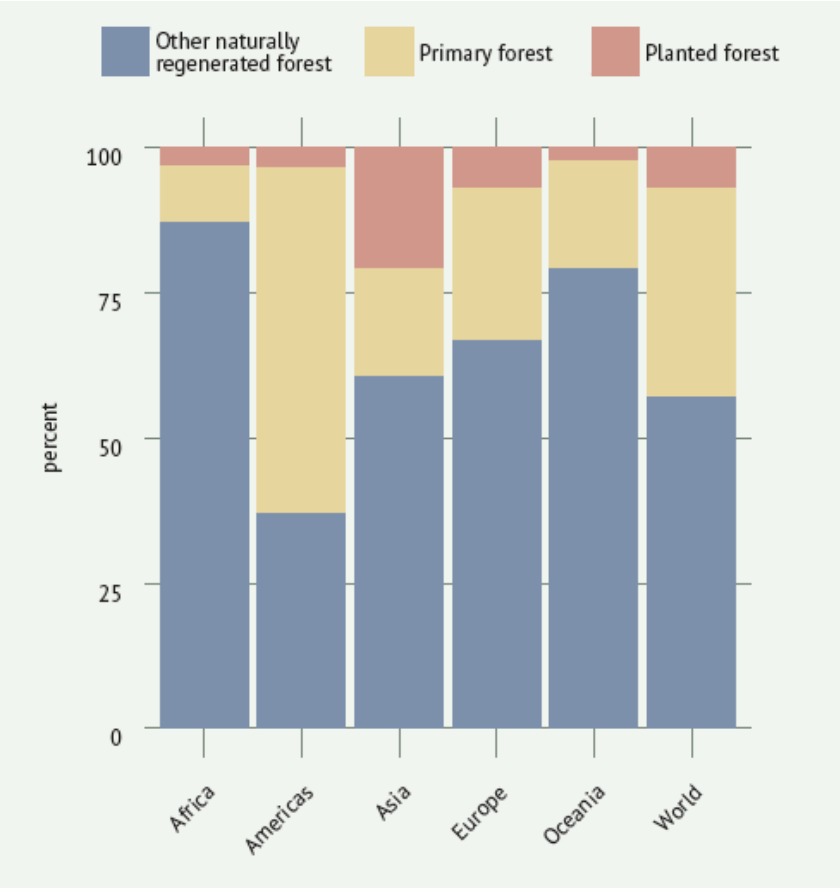

Fig. 1. The forest profile and characteristics in a worldwide context for the year 2010. Source: Food and Agriculture Organization of the United Nations (2013), Forestry Department: http://www.fao.org/docrep/018/i3107e/i3107e04.pdf, p. 204.

2 Fuelwood Features In An Environmental Overview

Environmental aspects of fuelwood production and energy use are expanded over a wide spectrum of applications, from the local land use up to global climate change, and from applications in smoky kitchens to electricity generation up to large-scale power plants. In parallel, environmental impacts of fuelwood production and energy use are valued both as positive and as negative, thus the environmental footprint of these impacts should be an integrated component of any contemporary fuelwood energy scheme upon energy policy making (Western Ghats Biodiversity Information System, 1999).

In the European context there is an extensive literature production upon the environmental perspectives of fuelwood exploitation in mountainous regions (Kyriakopoulos, 2010; Chalikias et.al., 2010; Kyriakopoulos et.al., 2010; Kolovos et.al., 2011). Such studies have expressed the pronounced role of natural forests, those unaffected by humans, which often contain a diverse range of both tree and non-tree species since all forests –even monoculture plantations– are reservoirs of biodiversity. Nevertheless, almost all forests in Europe have experienced more or less strong anthropogenic influences throughout history. Subsequently, even though forest areas are increasing in most European countries, the positive trends exceed the negative ones (European Environment Agency, 2006).

In mountainous forests an utmost importance issue –regarding a sustainable forestry management– is the residues' extraction. In particular, residues' extraction can in some cases be beneficial in terms of forest fires prevention. Woody harvest residues and deadwood constitute a fire risk in Mediterranean countries. Removal of biomass for bioenergy production could, thus, help to reduce the risk of forest fires and facilitate fire extinction. Furthermore, biomass originated from creating corridors of fire protection can be utilized in order to enable an added economic value to this operation. Generally, while the low utilization of annual increment has created positive conditions for biological diversity, some man-made forests have not been thinned. This phenomenon can be attributed to the lack of market demand and low prices. In such cases thinning for biomass utilization could provide an opportunity to open very dense coniferous forest plantations and improve the habitat value of these forests for many species (Chalikias et.al., 2010; Kyriakopoulos et.al., 2010). The main fuelwood features in an environmental overview are systematically presented in the following subsections of this section 2.

2.1 Deforestation

Deforestation is the consequence of the imbalance between the (limited) rate of fuelwood production and the (excess) rate of fuelwood consumption. Therefore, this "fuelwood gap theory" is mainly attributed to the aforementioned imbalance that was introduced at the seventies. In the framework of the "fuelwood gap theory" it is assumed that all fuelwood is produced by forest resources and that fuelwood consumption would increase at the same rate as population increase (Western Ghats Biodiversity Information System, 1999).

This "fuelwood gap theory" was the major consequence upon an overstated "fuelwood crisis" that was introduced in the global environmental agenda from the late seventies. In this extreme statement analysts –such as foresters, economists, and policy makers– in many countries structured erroneous projections of the rapid total destruction of the biomass resource. These projections were usually based on a simplistic supply and demand analysis, the so-called gap analysis that was extremely pronounced throughout most of the eighties. The setting goal of theses projections was the boost of fuelwood supplies without regard to local needs, priorities, or resource potentials-or to the economic viability of the plans (Mercer and Soussan, 1992). Nevertheless, other fundamental issues that enable the sustainable fuelwood management are apparent, such as the substantial supply of wood from non-forest

areas and responses of fuelwood users to scarcities, such as fuel switching, change of cooking habits, and development of alternative supply sources (Western Ghats Biodiversity Information System, 1999).

Nowadays the main reason of deforestation is the conversion of forest land into agricultural land and urban areas, due to the undergone growing population and the concurring increased demand for food. Contrarily, localized deforestation and forest degradation are not always considered the determining outcomes of unsustainable fuelwood production, since there are geographical regions, such as in Cebu (the Philippines), where commercial fuelwood trade can lead to the improvement of the local environment because it provides incentives to landowners and farmers and traders to plant trees under environmentally viable policies (Western Ghats Biodiversity Information System, 1999). On the other hand, fuelwood energy policies and programs are still commonly structured upon the aforementioned misconception, which leads to ineffective and even obstructing interventions, such as prohibiting fuelwood gathering from forests, restricting the transportation of fuelwood, and cook-stove programs that merely aim to reduce woodfuel consumption (Western Ghats Biodiversity Information System, 1999).

2.2 Global Climate Change

Serious environmental concerns like global climate change, being related to the use of fossil fuels, have currently revived the interest in fuelwood energy as a renewable, sustainable, and environmentally benign energy source. Therefore, fuelwood energy is a renewable energy source that enables sustainable and carbon-neutral production and exploitation. In particular, complete burning or decomposing of fuelwood emits carbon dioxide, but trees absorb carbon from the atmosphere through photosynthesis. Contrarily, natural decomposition or incomplete burning of fuelwood emits methane, while crop and livestock production alone are responsible for half of the methane and two-thirds of the nitrous oxide emitted into the atmosphere by human activity. Thus, from an environmental viewpoint, burning fuelwood residues from logging and processing is an environmentally beneficial process. Moreover, fuelwood does not emit sulfur dioxide, unlike the burning of fossil-based fuels of coal and oil (Western Ghats Biodiversity Information System, 1999; Food and Agriculture Organization of the United Nations, 2013).

Therefore –while emissions of greenhouse gases (GHGs) from agriculture, forestry, and other land uses contribute to global warming, sustaining comparable contribution to pollution caused by energy production and consumption, and far exceeding total emissions from transportation– energy produced from fuelwood can be used to reduce such greenhouse gas emissions related to energy use, by replacing fossil fuels. Subsequently, contemporary fuelwood energy applications are becoming more and more competitive with conventional applications. Other benefits of such applications are: employment generation, saving on foreign exchange due to reduced oil import, and upgrading of barren and deforested areas by energy plantations (Western Ghats Biodiversity Information System, 1999; Food and Agriculture Organization of the United Nations, 2013).

2.3 Emissions

Most fuelwood production in Asia is used by households in their traditional stoves. These stoves sustain low efficiencies and often burn wood incompletely leading to the emission of pollutants, including carbon monoxide, methane and nitrogen oxides. These pollutants deteriorate the health condition of the nearby population and increase the greenhouse gas emissions. Nevertheless, fuelwood is not valued as a dirty fuel itself that has to be replaced, but that traditional technologies are inadequate and need improvements. Besides, the optimum fuel conservation necessitates improved cook-stove programs that should be oriented to the aspects of health protection and users' convenience (Western Ghats Biodiversity Information System, 1999).

Finally, other negative repercussions on the ecosystems and on humans' well-being, are: soil salinity, aquifer depletion, and land degradation. This environmental depletion should reduce achievable yields and could put at risk farmers' ability to bridge production gaps and improve food security (Food and Agriculture Organization of the United Nations, 2013).

3 Discussion

An integrated evaluation of fuelwood management for energy production upon forestry sources should involve both environmental and financial viewpoints of analysis. Therefore, in this section it is also noteworthy to further denote the dominated economic entities of energy projects, by succinctly providing the relevant terminology, as follows (Khatib, 2003):

- Equity is an ownership right or risk interest in an enterprise.
- Payback period is the time taken for a project to recover its initial investment in monetary terms.
- Internal rate of return (IRR) is a discounted measure of project worth. The discount rate that just makes the net present worth of the incremental net benefit stream, or incremental cash flow, equal zero.
- Net present value (NPV) is the sum of discounted future benefits and costs at a stated rate of discount. NPV is an absolute measure of project merit.
- Opportunity cost is the value lost by using something in one application rather than another. The opportunity cost of employing a worker in a project is the loss of net output that worker would have produced elsewhere. The concept of opportunity cost is the corner stone of benefit-cost analysis.

Calculation of benefits in the electrical power industry is a complex issue, since a new power station would normally not only increase production, but also contribute towards reduction of the overall system cost of generation. Such infrastructure development should also reduce system losses and delay the implementation of some projects for network strengthening. In parallel, certain energy projects are redundant

and are made necessary by the need to ensure security of supply. Moreover, rural electrification is normally a source of financial loss, but has significant economic benefits. Some improvements in power stations –like inhibition of emissions– incur high investment, reduce electrical energy output and efficiency, and yet have sound environmental and economical benefits (Khatib, 2003; Chalikias et.al., 2010; Kyriakopoulos et.al., 2010).

In a financial overview, the guiding principle for the evaluation of such biomass-based energy projects is the maximization of NPV while utilizing, as a discount rate, the opportunity cost of capital. Besides, the IRR is not the only criterion to evaluate projects for investment decisions. Contrarily, NPV with a proper discount rate (reflecting the true opportunity cost of capital) is a criterion. With limited budgeting, a benefit/cost ratio has to be also calculated in order to assist the appropriate selection among all alternative energy-projected choices (Khatib, 2003; Chalikias et.al., 2010; Kyriakopoulos et.al., 2010).

In an environmental overview, the extensive use of coal results in groundwater contamination, land disturbance, changes in land use and long-term ecosystem destruction. Moreover, the dominated air and water pollution reflect the emissions of SO2, NOx, particulates. Such (indicatively stated) pollutants are badly affecting the environmental sustainability, causing air quality implications, heavy metals leachable from ash and slag wastes, possible global climatic change from CO2 emissions, as well as lake acidification and loss of communities due to acid depositions. Focusing the above environmental impacts on forestry biomass sources, it should be further noticed that these energy-projected schemes emit lower levels of SO2 compared to oil-fired or coal-fired projects, but could also sustain higher emissions of potential carcinogenic particulates and hydrocarbons (Khatib, 2003; Chalikias et.al., 2010; Kyriakopoulos et.al., 2010).

4 Conclusions

According to the development of the fuelwood crisis in the seventies, the perspective solutions of the relevant projections were self-evident; if projected fuelwood demands exceeded supplies, the solution was to plant more trees and shift the supply curve outward, or to devise policies to reduce demand and shift the demand curve inward. Nevertheless, most of these efforts failed to have lasting effects on fuelwood scarcity or forest depletion. These failures signified the need of rethinking upon the fuelwood crisis. Although specifications between and within regions are versatile, fuelwood problems should be holistically seen as manifestations of more fundamental failures in rural land, labour, and capital markets, urban energy markets, and failures of governments (local and national) to establish the conditions that would foster efficient and sustainable allocation of land and resources between forest and cropland and wood and food production (Mercer and Soussan, 1992).

Fuelwood problems are currently recognized as rarely generalizable, since these problems sustain inherently complex causes of varied forms. Such problems reflect interactions between local production systems and the environmental resources on

which they are based. Therefore, the significance and origins of fuelwood problems are differentiated from region to region, as well as from rural to urban areas within the same district. Besides, these problems reflect changes to economic and environmental relationships that affect local supply and demand; changes that can be (Mercer and Soussan, 1992):

- gradual, such as erosion of local woodlands as a result of land colonization, increased herd sizes in semiarid regions, increased exports of fuelwood to meet growing urban demands, or lower quantities of residues available as fuel, as a result of changing agricultural practices.
- sudden and catastrophic, such as a large-scale deforestation associated with giant development schemes, mass influxes of refugees, and environmental collapse associated with droughts, floods, or other extreme climatic events.

Whether gradual or rapid, these changes are utmost importance aspects of fuelwood problems and constitute the driven forces to effectively grab the open opportunities and effectively confront the arising disputes upon all counterparts involved in contemporary fuelwood policies (Mercer and Soussan, 1992).

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The Front End Design of a Health Monitoring System

Nikos Petrellis[1], Michael Birbas[2], Fotios Gioulekas[3]

[1]Department of Computer Science and Engineering, Technology Educational Institute of Thessaly, Greece, e-mail: npetrellis@teilar.gr
[2]Analogies S.A. and Electrical Engineering and Computer Technology Dept., University of Patras, Greece, e-mail: michael.birbas@analogies.eu
[3]Sub-directorate of Informatics, University General Hospital of Larissa Larissa, Greece, e-mail: gioulekas@uhl.gr

Abstract. In this paper an efficient e-health platform based on a low-cost sensor controller system is presented, exhibiting enhanced key characteristics able to provide broad coverage of medical scenarios in a reliable and flexible way. The heart of the system is a low-cost sensor controller capable of performing both simple medical tests and more advanced ones communicating with a Gateway and a tablet or smart phone providing instructions to the patient. Equipped with a simple and flexible communication protocol for data and command exchange, the developed platform is capable of readily supporting a variety of sensors with different sampling profiles. Furthermore, first promising results of on-going work pave the way for achieving considerable enhancement of sensors' accuracy (close to high-cost commercial ones) and significant extension of platform's portability through power consumption minimization. These characteristics have been verified by experimenting with various medical scenarios one of which is demonstrated here in detail.

Keywords: health monitor, sensors, communication protocol, low power

1 Introduction

Modern mobile health monitoring systems are classified to two major categories, a) systems based on commercial sensor infrastructures, b) systems based on low-cost open source solutions. Specifically, in (Gay and Leijdekkers, 2007), the authors have proposed a monitoring system based on wireless sensors and smart phones to monitor the wellbeing of high risk cardiac patients exploiting the usage of a real-time ECG. They use a Bluetooth enabled blood pressure monitor and weight scale from A&D Medical A&D (Medical website, 2007) and an integrated Bluetooth ECG/Accelerometer sensor from Alive Technologies (Alive Technologies, 2007). These sensors communicate with the smart-phone using Bluetooth technology. The smart-phone connects to WiFi or through GSM and transmits data to the remote gateway. The sensors are based on commercial products and it requires the usage of an expensive smart-phone to serve as first hot-spot before the connection to the server. Additionally, the work in (Chan et al, 2008) proposes also a similar

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monitoring architecture like that in (Gay and Leijdekkers, 2007) based on commercial sensors.

Furthermore, the work proposed in (Mukherjee et al, 2014) introduces a perception layer, where a processing device incorporates Bluetooth, Zigbee και WiMAX protocols to connect the patient sensors to the monitoring infrastructure and collect the corresponding data. These sensors produce raw values of data which are wirelessly relayed to a central transceiver unit worn by the patient. This transceiver unit processes the raw data and converts it into meaningful metadata. The authors of this work focus on the protocol implementation rather than low-complexity and low-consumption sensors and integration platform. Authors in (Patel et al, 2012) analyze and review the available sensor technology, communication technology, and data analysis techniques towards the implementation of wearable systems and patient monitoring, denoting the importance of the development and usage of both high-accurate and low-energy sensors. It is also suggested in (Khelil et al, 2014) an experimental Body Sensor Network platform that measures important health indications, and maps the health status of the individual carrying the platform into a set of predefined classes. They employ a commercial-off-the-shelf (COTS) low-cost platform, the e-Health Sensor Shield (Cooking-Hacks, 2013) from Libelium Cooking Hacks which relies on two popular sensing and computing platforms i.e., Arduino and Raspberry. However, no information is given for the important features of such a platform, like the communication protocol employed for data/command/exchange, power consumption and sensors' accuracy. Finally, the work proposed in (Granados et al, 2014) is based on a gateway design that performs digital filtering of vital signs signals, as well as streaming to Web clients. The powering capabilities of the gateway are based on PoE (power over Ethernet) that can also serve as a power and data source for wired sensors and building automation appliances. Alternatively, there exist a number of commercial platforms like e-Shimmer Health BSN (The Shimmer Platform, 2008), and the Simband health sensor platform (SIMBAND, 2014) from Samsung which are expensive solutions though with proprietary components without providing HW open-source features. The MIThril system (MIThril, 2003) is based on monitoring using wearable systems that employ multiple sensors that are typically integrated into a sensor network either limited to bodyworn sensors or integrating body-worn sensors and ambient sensors. However, such systems by design are not suitable for long-term health monitoring.

As far as the current work is concerned, the low-cost e-Health kit of Libelium-Cooking Hacks (Cooking-Hacks, 2013) has been employed as basis (sensor controller) for the implementation of an efficient e-health platform. In comparison with similar works we further focused in significantly improving its key features, having developed a communication protocol able to serve any kind of sensors' sampling profiles and derived first promising results in sensor's accuracy enhancement and power consumption minimization, aiming towards the development of a low cost flexible e-health sensor platform able to support in a reliable as many medical cases as possible.

The description of the work performed and the developed platform are organized as follows: in Section 2 a description of the overall e-health platform is given while in Section 3 we focus on the sensor controller. In Section 4 the developed communication protocol between the Gateway and the Sensor Controller is

described, in Section 5 first promising results of on- going work are presented while finally in Section 6 a representative medical scenario is described demonstrating the effectiveness of the presented techniques and methods.

2 System Description

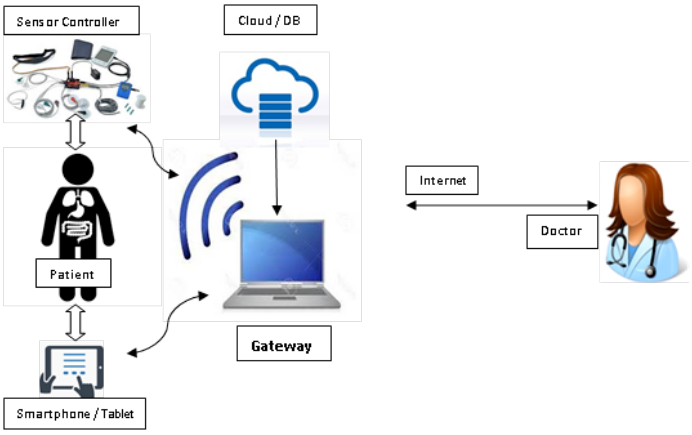

Fig. 1. The framework of the health monitoring system

The system description of the heath monitoring system is shown in Fig. 1. In such a system, the monitored patient, accepts instructions through a smart device (phone or tablet) offering a comprehensive user interface like e.g. a wide touch screen with large buttons or a mobile phone/tablet with voice recognition system

Medical sensors employed in this use include both simple tests (temperature, respiratory measurements, skin conductance, etc) and/or more advanced ones (like Electrocardiograms-ECG, Electromyograms-EMG) which are connected to the Sensor Controller usually based on a lightweight (but powerful enough to cover system specifications) portable microcontroller module. A Gateway is furthermore employed which is in most cases positioned at patient's personal place and is connected to the Sensor Controller through a wireless protocol like Wi-Fi.

A communication protocol is responsible for the transfer of the Gateway instructions to the Sensor Controller concerning the sensors that should be used and their sampling frequency. It should be stressed that the choice of an appropriate communication protocol is not a trivial issue since a variety of sensors has to be controlled with different sampling profiles.

Power consumption is another crucial issue since it is directly aligned with the degree of the platform portability that could be provided to the patient. To ensure that portability is supported, the system power supply, usually a light battery, should last sufficiently long before being recharged. It should be noted at this point that the main parameters through which power consumption can be affected are limited to the

platform's microcontroller operation and the wireless communication protocol controlled, since the power required by the controlled sensors cannot be touched.

The Gateway is providing an intermediate node between the patient, the doctor/hospital and the tablet/smartphone. Its main tasks include the communication with the Sensor Controller and the tablet to forward the instructions to the patient and to gather the medical test results from the Sensor Controller. These test results can be forwarded either directly to the doctor or a hospital data base or to the cloud. Some trivial tasks and decisions can be directly taken by the Gateway like e.g. in the case where the room temperature exceeds predefined limits, while it should also activate appropriate alarms if the patient delays to respond, etc.

The ordinary sensors used in health monitoring systems are grouped in two categories: simple sensors with analog interface (like temperature, respiratory, etc) which might call for some special range adaptation circuitry to connect to corresponding ADC channels and smart sensors with digital interface (like blood pressure measurement, etc) with predetermined accuracy.

3 Sensor Controller

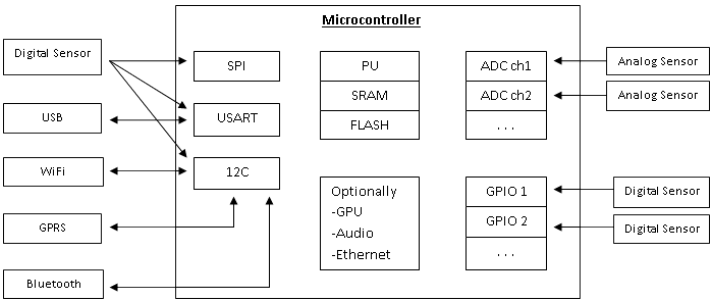

Fig. 2. Block Diagram of the Sensor Controller

As shown in Fig. 2, the Sensor Controller is a "mobile microcontroller board the rough functionality of which is described in the block diagram above. The analog sensors are connected to separate ADCs and/ or to different channels of the same ADC. So as to achieve matching of the sensor output to the ADC input, without linearity degradation, range adaptation circuits might have to be employed, including either passive components like voltage dividers or Wheatstone bridges in the simplest case or active circuits like operational amplifiers, while voltage shifting circuits may also be required. Such range adaptation circuits have to be designed carefully so as to ensure high linearity and low noise.

As far as smart sensors with digital interface are concerned (Fig2), they are connected to serial buses like Serial Peripheral Interface (SPI), I2C or USART/UART according to the interface provided by the specific sensor. However, the communication boards used to transfer information between the Sensor Controller and the Gateway may also need to be controlled by one of these interfaces. This might lead to conflicts regarding the sensors that should be connected directly to

the Sensor Controller since the serial bus interface resources are limited. The sensors with the simplest communication protocol can be alternatively connected to General Purpose I/O (GPIO) pins that will be configured to operate in the same way as the serial bus supported by the sensor. However, the software drivers that will be needed to emulate the operation of such a serial bus may be a significant overhead.

It is important that the Processing Unit (PU) and the size of the internal RAM and Flash memory allow for the use of a Real Time Operating System (RTOS) so that several real-time tasks could be handled in parallel. Furthermore, if the RTOS offers a Graphical User Interface (GUI), the development and debugging process of the health monitoring system is also simplified reducing the time to market. Another important characteristic is the size of the SRAM and Flash memory in the sense that it should be adequate to store firmware with high complexity. As far as real time operation is concerned, the Sensor Controller is usually placed on a table or carried by the patient when the medical tests have to be performed. The Sensor Controller communicates with a Gateway through a wireless protocol like Wi-Fi or Bluetooth.

The current work uses as reference development platform the low cost e-Health kit of Libelium-Cooking Hacks, which exhibits most of the aforementioned features. The supported sensors with analog interface can measure: temperature, skin conductivity, position, breathing airflow, ECG and EMG (EMG cannot operate concurrently with ECG) while the digital sensors offered are: blood pressure (connected to UART), measurement of pulse and oxygen in blood (requires 8 GPIO pins) and glucometer (connected also to UART and thus cannot operate with blood pressure sensor concurrently). The e-Health kit platform can be directly plugged onto an Arduino development board or to a Raspberry PI through an Arduino bridge. The basic functionality offered by the Arduino bridge is the rearrangement of the Raspberry digital pins so as to provide Arduino-compatible headers. An additional ADC has been also placed on the Arduino bridge to increase the number of analog inputs offered by the Raspberry PI.

Due to the higher processing power (32-bit ARM core) of Raspberry PI and its increased RAM/ROM size compared to the 8-bit AVR microcontroller that forms the core of Arduino, Raspberry PI was selected to serve as Sensor Controller. Moreover, the advanced GUI offered by the Raspbian OS installed on the Raspberry PI board makes possible the use of the Sensor Controller in stand-alone mode. An SD card is required by the Raspberry PI to install the Raspbian OS which is also used to store temporary data and command files required for the communication with the Gateway. Finally, the stacking of the e-Health kit over the Arduino bridge and the Raspberry PI allows for the placement of a wireless communication module between the Arduino bridge and the eHealth kit as shown in Fig. 3. Both Bluetooth and Wi-Fi interfaces were considered as candidates for the wireless communication between the Sensor Controller and the Gateway. The Wi-Fi interface was finally selected due to its higher reliability and the incompatibilities discovered between the Bluetooth card used at the Sensor Controller and the smart phones tested. The connectors on the top of Fig. 3 are used to connect the sensors listed above.

Based on this experimental setup (Fig. 3), we focused on the definition and implementation of an appropriate communication protocol for the health monitoring system while also successful results were derived so far on both the improvement of sensors' accuracy and minimization of power consumption as part of on-going work.

4 Communication Protocol

The communication protocol is responsible for the data and command exchange between the Gateway and the Sensor Controller. The commands are used by the Sensor Controller to schedule the appropriate intervals that the various sensors should be sampled according to the supported medical case study. Various methods like HTML server or clouds could have been employed to support the wireless data exchange between the Gateway and the Sensor Controller, but in our case we preferred to have the Gateway configured as an FTP server since exchanging command and data text files is more convenient for debugging and logging purposes. This message passing communication protocol is implemented through two file types: command and data, that are exchanged between the Gateway and the Sensor Controller. The command file has the format shown in the example of Fig. 4 and is prepared by the Gateway according to instructions set by the supervisor doctor.

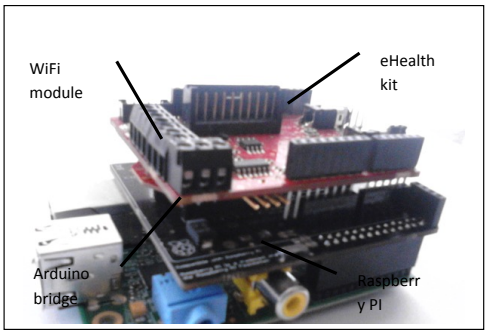

Fig. 3. Stacking of the basic modules of the Sensor Controller

The first line of such a command file defines whether the system will go to sleep mode for a predefined interval or will perform a sampling scenario (lines starting with -- are comments). In the case of Fig. 4, the first line determines that a sampling scenario is to take place. Specifically, in the first line (of Fig. 4), the first character is either (R) or (S) denoting that the sensor controller will either enter a sampling or a sleep mode respectively. Two integer numbers follow which represent parameters Q(uantum) and I(nterval). The Q parameter represents a time interval expressed in us, while the I parameter defines that the command file will be read again by the Sensor Controller after a delay of I ms. If the application software on the side of the Gateway does not change this file, the same sampling scenario will be repeated by the Sensor Controller (every I ms).

Each pair of the following lines (ignoring the comments) is assigned to a specific sensor. The first line of each pair of lines associated with a specific sensor defines only an integer number N that corresponds to a sampling interval equal to N×Q (in ms) for this sensor. If N is selected to be 0 this means that the specific sensor is not used. The second line in each pair is reserved for future options.

Based on the specification described above, the Sensor Controller software initially reads the command file and starts a loop during which, the sensors with non-

zero N are sampled. A sleep interval of Q ms is inserted before the next iteration. When each sensor s is sampled it is omitted from the sampling process for the next Ns iterations in order to create the Ns×Q pause interval between successive samples.

The data samples are stored in files that are transferred back to the FTP server. The data files can contain mixed sensor indications distinguished by the sensor name and followed by the sampled value and a timestamp. Optionally, different files can be used to separate the sensor values according to the configuration set by the Gateway.

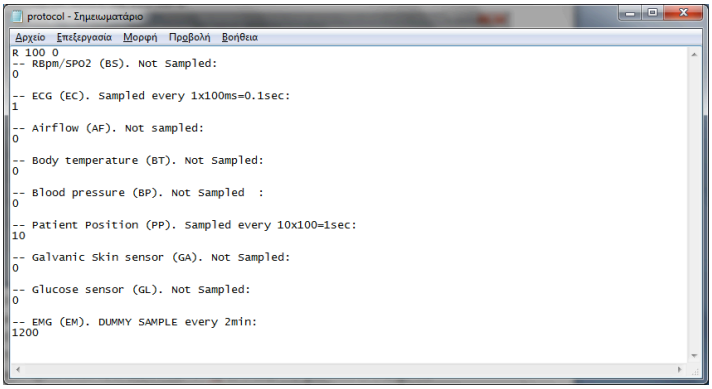

Fig 4. Sampling ECG (every 100ms) and patient position (every 1 sec) sensors.

5 On Going Work

The on-going work is towards enhancing the sensors' accuracy and lowering significantly the platform's power consumption.

Sensor Accuracy enhancement

As already described in section 3, for specific sensors (like analog ones) it is necessary that they undergo a (hardware) calibration scheme (e.g. use of Wheatstone bridge techniques etc) to update default parameters so as to ensure sufficient accuracy. These (hardware) techniques suffer however from several drawbacks, such as sensitivity to environmental, temperature and power supply variations, etc.

In contrast to this approach on going work has been focusing in the improvement of the accuracy of this type of sensors measurements through software instead of modifying the hardware of the eHealth development platform. More specifically, the calibration values are stored within configuration files that are updated by the Raspberry PI microcontroller system using information about environmental conditions. Then, a filtering procedure takes place using a simple moving average with extreme value exclusion. More specifically, first a moving average is applied on the last k sample values (v_t, v_{t-1},…, v_{t-k+1}),and an initial average A_{in} is estimated. Following this, each v_i of the k values is compared with A_{in} and if their difference exceed a predetermined threshold T_h, then a corresponding binary flag m_i is set to 0 otherwise it is set to 1. After updating all the m_i values, the final average A_{fin} is

estimated and finally used. Application of this technique to a number of sensors (like airflow, skin conductance and temperature measurement sensors) has so far given very satisfactory results with the processed measurements being close enough to ones from (expensive) medically certified sensors.

Power Consumption

Another crucial factor where we are targeting to, (on going work), is the minimization of the power consumption and especially that of the Sensor Controller (as well as of the WiFi module) through the exploitation of the idle intervals of these devices between measurements by putting them in a sleep like mode. Experimental measurements show that the power consumption at full operational mode (when all the sensors are connected) exceeds 1A which means that if an external 1000mAh battery is used it would have to be recharged every hour. Sleep mode for the WiFi module (Roving Networks RN-171) can be readily enabled where only 4uA is consumed (compared to the 35 mA and the 185-210mA required at normal mode at the receive/transmit path of the device respectively).

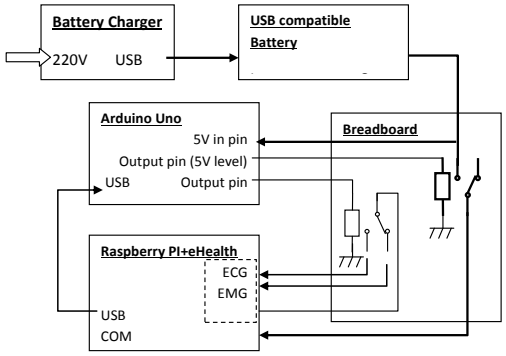

Fig. 5. Arduino-Rapsberry block diagram to implement low-power consumption

However this is not the case for the specific (Rapsberry PI) microcontroller board that does not support sleep or any other low power mode. For this reason, an additional low cost/power microcontroller that supports sleep mode is employed, (Arduino in our case) just to turn off and on the Raspberry PI module, as shown in Fig. 5 through the use of mechanical relays. Specifically, although the Arduino module is constantly powered by the external battery, the Raspberry PI is powered through a relay the normal position of which is off. When the Arduino is powered up, it immediately switches on the relay, powering the Raspberry PI, while also the Arduino can turn off the Raspberry PI for a predetermined sleep interval if it is instructed to do so by Raspberry PI. It should be noted that the 8-bit ATmega1280 microcontroller used on the Arduino board draws less than 1mA in normal operation and less than 1uA in power down mode. Important power savings have been achieved, and the battery life has been extended from just few hours to days.

6 Case Study

As a demonstration of the issues discussed in previous let's assume that the following medical scenario needs to be performed: a) initially the patient position is tested every second for 4min in order to verify that he has taken the right position for the following tests, b) an ECG test should be performed for 2min with 0.1sec intervals, c) after 10 minutes break its blood pressure should be measured just once. It should be noted here that the patient position has to be concurrently monitored in both (b) and (c) tests to verify the validity of the examinations and thus the patient position sensor is sampled every second. To implement this medical scenario, the following actions have to take place:

A command file with a sleep instruction may have been deposited at the FTP server from the last measurement and the Raspberry PI wakes up, reads this file and falls in sleep mode again until a different than sleep command is found in this file. The tablet instructs the patient to wear the position and the ECG sensors.

The patient wears the patient position sensor and the ECG electrodes, switches on the Sensor Controller module and notifies the tablet that he is ready. The Gateway is notified through the tablet to change the command file into a new one that instructs the Sensor Controller to wake up and enter the sampling mode (1st character of first line of command file is R followed by Q=1000 and I=0)) where only the patient position sensor is instructed to be sampled every 1x1000mss=1 sec (N=1 in the line of the command file corresponding to the specific sensor) as well as the EMG sensor (dummy sampling every 4 min-N=240 in the command file line corresponding to this sensor). This command file has as effect that the patient position sensor is sampled immediately (after the command file is read by the Sensor Controller) every second for N×Q=240x1000=4min when a dummy read to the EMG sensor is performedThen, immediately the command file will be read again from the FTP server and the patient position data will be sent to gateway

The Gateway during the 4 min interval described above prepares the command file shown in Fig. 4, which instructs the sensor controller to perform the ECG test for 2min. If this modified command file (Fig.4) was not prepared within the 4min interval, the patient position will be monitored for another 4 min interval before ECG starts. After the ECG test is completed, the data are sent to the FTP server and the command file will be immediately read again. This command file could have been modified by the Gateway in the last 2min interval during the 10 min sleep mode so that preparations for the blood pressure test take place. The patient in this time window removes ECG, measures his blood pressure and connects the instrument to the Sensor Controller.

After connecting the blood pressure instrument to the Sensor Controller the patient notifies the tablet that he has performed the measurement. The Gateway will alter the command file to prepare the transfer of the measurement which takes place after the Sensor Controller wakes from the 10 min interval. Following the reception of the blood pressure measurement by the Gateway, the command file can be changed to sleep mode until the patient is instructed by the tablet to turn it off.

Regarding the amount of power consumption required, it is derived that the whole energy consumed per day for this case study 111566.6mA×sec. This means that a

1000mAh battery would last 1000×3600/111566.6, i.e. more than 32 days before a recharge is needed.

7 Conclusions

A low-cost platform for remote heath monitoring of patients was presented. The system's sensor controller is based on the e-health kit from Cookie-Hacks being capable of performing a number of medical tests from temperature measurement to Electrocardiograms. A flexible communication protocol allows for the determination of any type of short or long term sampling of sensors at the desired frequency. This feature in combination with first promising results derived on sensor's accuracy enhancement and power consumption optimization opens the way for a low-cost system with its key characteristics comparable to those of high cost commercial ones.

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Diversification Factors of Cultivators/Investors of Robinia pseudoacacia (Black locust)

Stavros Ch. Tsiantikoudis[1], Spyros Goumas[2]

[1]Department of Forestry and Management of the Environment and Natural Resources, Democritus University of Thrace, Orestiada, Greece, e-mail: stsianti@fmenr.duth.gr
[2]Department of Accounting and Finance, Piraeus University of Applied Sciences, Greece, e-mail: sgoum@teipir.gr

Abstract. In an effort to minimize environmental degradation caused by the intensive use of agrochemicals, European Union adopted regulations relevant to afforestation and set aside of agricultural land. The multifunctional role of agriculture enhanced through these regulations and provided adequate motives for a change in the conventional land uses. Cultivators/investors that are interested in afforested agricultural land find them quite attractive and revealed an interest in implement them. In order to investigate the factors that influence the probability of adopting the above mentioned regulations we organize a research to the related cultivators/investors. For the collection of data we used questionnaire and the lists of approved for aid from the Regulations 2080/92 and 1257/99. Finally we collected 205 valid questionnaires from a) farmers by main occupation and b) other owners of agricultural land who are not farmers by main occupation. In this study we used a linear regression and a logistic regression model.

Keywords: Regulations, cultivators/investors, Black locust, Evros regional unit

1 Introduction

In the last decades we notice a change in the consideration of rural development due to the successive revisions of the Common Agricultural Policy (CAP). Intensive agriculture is no more the leading developmental sector of rural areas. The multifunctional role of agriculture, that enhances the natural environment, gradually is been taking place in these areas: environmental, cultural, nutritional, social and developmental (Arabatzis et al., 2006a; Arabatzis et al., 2006b; Arabatzis 2008; Chalikias et.al 2010 (4)). Developmental initiatives of the European Union aim to the enhancement of the multifunctional role of rural areas, as the LEADER programme (Andreopoulou et al., 2008; Arabatzis et al., 2010; Arabatzis et al., 2011). In the CAP framework, EU instituted regulations EC2080/92 and EC1257/99 providing incentives for the reforestation of agricultural land boosting forestry (Arabatzis, 2010). The above mentioned regulations introduced the necessity of producing energy through forest plantations and the role of related farms (Chalikias et.al 2010,

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Chalikias 2010, Chalikias and Christopoulou 2011, Kyriakopoulos et.al 2010a, 2010b, 2010c, Kolovos et.al 2011). Also, afforestation of agricultural land play significant role in the enhancement of local quality of life (Chalikias 2013, Chalikias and Kolovos 2013).

2 Research Methodology

The survey was conducted in Evros regional unit. Evros area is characterized by rich natural resources that contribute mainly in development of primary and tourism sector (Arabatzis and Grigoroudis, 2010; Grigoroudis et al., 2012, Chalikias 2012). Also, there are significant afforested, with Black locust, areas of agricultural land in Evros comparatively with other areas.

The questionnaire included questions mostly closed type with predetermined answers. The questionnaire investigated the individual and social characteristics of cultivators/investors farmers, the structural characteristics of their land and their attitudes to forest plantations. The questionnaires were collected in the period April-May 2012 by personal interviews at cultivators'/investors' residence or place of work. Finally we collected 205 valid questionnaires that represented a) farmers and b) other owners of agricultural land who were not farmers by main occupation.

The purpose of this study is to explore the factors that differentiate cultivators/investors, and the factors that influence their income. The data processing was done with STATA statistical package and methods of descriptive statistics. A linear regression model and a generalized linear model (a logistic model) have been applied.

The variables used in the models are given below:

Education: What education level has the cultivator/investor (1=none, 2 =primary education, 3 = obligatory education, 4 = secondary education, 5 = tertiary education).

Age: Age of cultivator/investor (in years).

Gender (1 = male, 2 = female).

Family size: Number of members in the family (1-10).

Income: Annual income in euros

Cultivator/Investor: (1 = main occupation is farming, 2 = secondary occupation is farming).

Associations: (1= Yes, 2 = No)

Seminars: (1 = Yes, 0 = No).

Educational tv, radio broadcasts: (0 = never, 1 = rarely, 2 = occasionally, 3 = often, 4 = very often).

Experience: Number of years of farming as main occupation.

Heredity: (1 = father was a farmer, 0 = father was not a farmer).

Area: in ha.

Agricultural holdings: No of agricultural holdings

Type: Type of species plantations (1 = Poplar, 2 = Pine, 3 = Black locust, 4 = Walnut) (1=Poplar, 2= Black locust, 3= Mulberry, 4= Walnut).

Reforestation: Worked in reforestation (1 = Yes, 2 = No).

Value: (0 = no increase in the value of agricultural land in the region over the past 5 years, 1 = increased, 2 = remained stable).

Profit and loss account: (0 = no records, 1 = yes).

Laws: Aware of others regulations for the agriculture (1 = Yes, 2 = No).

Forest: There is a municipal/community forest near the plantation (1 = Yes, 2 = No).

Market: Purchased of land for productive purposes before installing forest plantations (1 = Yes, 2 = No).

Lease: Land hiring before installing forest plantations (1 = Yes, 2 = No).

3 Results

We used a linear and a generalized linear (logistic) model. Applying the logistic model we found and compared the characteristics and factors that differentiate those who have agriculture as their main occupation to those who have it as secondary. The choice of the most appropriate model was stepwise regression with pe (0.1) and pr (0.2), the dependent variable (the farmer) is categorical. Table 1 shows the coefficients of the model.

Table 1. Coefficients of the logistic model

Variable	B	S.e (β)	P value
Education	-0.45	0.08	0.000
Articles	-0.73	0.33	0.026
Associations	-0.99	0.76	0.195

The model was tested for its validity with Hosmer Lemeshow test (Hosmer and Lemeshow, 1978) that explores the good adaptability. The null hypothesis was found not rejected and the model has good adaptability (P-value = 0.121). Also, to test good adaptability was used the figure 1 below by showing the deviance of the model (corresponding measure to residuals in linear regression). The model has good adaptability, since most estimated values (predicted values) have deviance below 0.05 which appears on the shaft of Cook's Distance (Cook and Weisberg 1982).

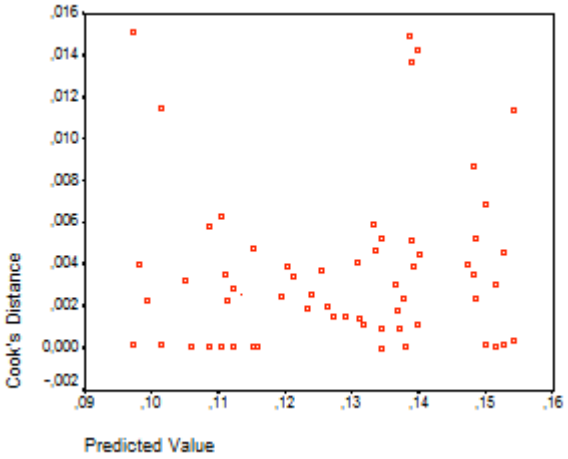

Fig. 1. Cook's Distance

Thus, we conclude that the factors that differentiate the cultivators/investors whose main occupation is agriculture to other farmers are the educational level, the fact that they have read articles with rural content and their participation in associations.

We examined the factors that shape the agricultural income for farmers by main occupation. So by linear regression with the dependent variable, the income of the cultivator/investor and independent almost all variables in the table mentioned previously, with Collet's approach we selected the following model (Table 2):

Table 2. Linear model's coefficients

Variables	B	S.e (β)	P value
Lease	14,178.408	4,712	0.003
Gender	-10,270.92	3,012	0.001
Family size	3,916.11	116	0.000
Associations	-253.42	153	0.101

For the validity of the model we examined the regularity of residuals with appropriate statistical tests (Sh.Wilk, S.Francia) and diagrams (histogram, Q-Q plot).

4 Discussion - Conclusions

From the linear model we find that the factors influencing farm income are gender, leasing and the number of family members, etc. From the logistic model by examining how the statistically significant independent variables affect the dependent (income) we found that the vast majority of farmers by main occupation have not finished secondary education, while the figures for the remaining are significantly smaller. From the interpretation of the corresponding coefficient of the model we conclude that for each increase in educational level of a unit (as defined earlier) the probability that the farmer has agriculture as main occupation rather than secondary reduces by 1- exp (-0.45) = 20.1%.

Moreover we noticed that by main occupation farmers read fewer articles than others. Interesting is that, there is no statistically significant difference in income and loans to cultivators/investors, and there is a difference in income from agriculture.

Moreover statistically significant difference has the cultivator/investor located near community forest in relation to the others (the corresponding averages are 11.19 thousands euro versus 17.50).

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Session 6: Regional Sustainability & Agrotourism

Sustainability Empowerment and Lifestyles: ICTs for New Food Behavioral Models[1]

Gian Paolo Cesaretti[1], Maria Carmen de Angelis[2], Rosa Misso[3], Safwat H Shakir Hanna[4]

[1]Simone Cesaretti Foundation, Italy, e-mail: presidente@fondazionesimonecesaretti.it
[2]Simone Cesaretti Foundation, Italy, e-mail: dottmarideangelis@gmail.com
[3]Department of Economics and Law Studies, University of Naples "Parthenope", Italy, misso@uniparthenope.it
[4]Texas Gulf Coast Environmental (TEXGED) Data, Prairie View A&M University – USA, safwat_shakir@yahoo.com

Abstract. Recognizing the important role that modern Information and Communication Technologies (ICts), and in particular the Internet, can play in determining the so-called "*Sustainability Empowerment*" ("*the ability to make the Right to Sustainability a constitutive principle of a new global society where well-being and its sustainability, in time and space, constitute its fundamental strategic goal*"), the present paper highlights a web project that takes for example the short supply chain model as a reference to a sustainable food lifestyle. This with the purpose of highlighting the importance to guide the visitors to new patterns of food behavior most functional to the maintenance in time and space of a new well-being paradigm.

Keywords: Sustainability of well-being; Shared Social Responsibility; ICTs; Food behavior; Lifestyle; Short supply chain.

1 Introduction

The globalization of the markets without a well-defined legal guidance, capable of overriding its rules and rights, surely it takes far away from the threshold of a sustainable well-being and universally recognized. The current world backdrop isn't comforting. The inequalities, that segment the planet separate it on parameters primarily based on mercantile vision. All this hinders the achievement of Sustainability Empowerment that, as stated by Cesaretti (2014) refers to the "*the ability to make the Right to Sustainability a constitutive principle of a new global*

[1] The work was carried out within the framework of the "New Orto Chain", a project coordinated by prof. Gian Paolo Cesaretti and done in partnership between the research institutions Di.SEG - Parthenope University and Simone Cesaretti Foundation and the OP businesses TerraOrti, F.lli Esposito and Azienda Agricola La Morella. The project has received funding from the measure 124 of the PRS 2007-2013 of the Campania Region.

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society where well-being and its sustainability, in time and space, constitute its fundamental strategic goal".

This preliminary remarks helps to understand why the current well-being paradigm, mainly oriented towards a mercantile approach is not designed to achieve the aim of Sustainability Empowerment. At this point it becomes fundamental a change of the paradigm of Dominant Well-being, in favour of a model based on the concept of *Integrated Universal Well-being*. If this would happen for consumers would result new lifestyles functional to the new paradigm.

This cannot be separated from the context in which all stakeholders, including consumers, move and compare themselves. In this regard, it is introduced the concept of *Sustainability Oriented Territories* where it is actually applied the model of Shared Social Responsibility. In these territories all stakeholders move responsibly, parameterizing their behavioral models to sustainable criteria. Within a Shared Social Responsibility model the ICTs play a crucial role, because they can be promoter of lifestyles compatible with creation, but especially with the maintenance in time and space, of the conditions of individual and collective well-being.

In particular, the starting point of this work is to recognize the unquestionable ability of ICTs, especially of Internet, to promote behavioral patterns and lifestyles more compatible with the objectives of Sustainability Empowerment by providing information that allows users to have an immediate idea of the possible alternative compared to dominant behaviors.

In this regard, the work serves as an example the web project developed by Simone Cesaretti Foundation named "The Portal of Sustainability": a free tool aimed at the promotion of a Culture of Well-being Sustainability. The portal, built around the areas of Well-being, in particular, includes a section dedicated to food by which are disseminated and promoted lifestyles compatible with what has been described as Food for Sustainability and not Just Food. In particular, in that section, values were promoted under the concept of short supply chain, as value system for eating patterns that are compatible with the goal of Sustainability Empowerment.

2 Sustainability Empowerment and Lifestyles

The current global society, aimed essentially at a mercantile approach, does not allow applying a Sustainability Empowerment Strategy (Cesaretti, 2014; Borrelli et al., 2013). One of the founding elements of the concept of sustainable well-being lies in a condition of global equity within and between generations.

In this sense, the overcoming of global inequality is a crucial prerequisite to achieve the aforementioned Sustainability Empowerment. Sustainability of well-being, understood as a right able to ensure its applicability on a planetary scale, in fact, does not yet exist. Imbalances, deep-seated in global society, heavily involved in the *System*, are those that hinder the process of overcoming inequalities. From this "G*lobal Society System*" derives a Well-being Paradigm totally unbalanced compared to its visions and aims. Not surprisingly the current reference model does not respond to the approach of universal well-being but rather to segmented approaches of well-being, especially to a mercantile vision. Putting sustainability at the heart of a new

global society project, it determines the move from segmented approaches to well-being to a one so to tell which is integrated with every single sustainable aspect of multiple segmented approaches.

Compared to it the result would be that, by changing the current paradigm of well-being according to criteria of sustainability, the "*Global Society System"* can finally find its way around new "sustainable" parameters, able to establish a new right: the "Right to Sustainability" (Cesaretti et al., 2015).

From this, in the name of a change on a global scale, we would have new behavioral models themselves voted for individual and collective well-being, worldwide sustainable. The symbiotic relationship between an Integrated Well-being Paradigm and new behavioral models related to it, assumes a responsible behavior by all stakeholders of the territorial systems. In this sense, starting from a more micro reality which is the territory, until another more macros which is the Planet System, all stakeholders must take responsible behavior. The business world, policymakers, the media, the information play a crucial role. Each stakeholder, in the context of a Shared Social Responsibility model, should, by adopting a responsible attitude, take consistent positions with a new model of Well-being Sustainability (Borrelli et al., 2013; Blasi et al., 2008; Van der Ploeg, 2006).

In this perspective, if among the various stakeholders of a territory we focus on consumer because it is *"the subject that, in aggregate perspective, creates the offer",* you can instantly understand how its behaviors and lifestyles can be functional to Sustainability Empowerment. Consumers, in fact, according to our own lifestyle can make daily choices, becoming a critical factor for the change of the model of "Well-being offer" in a territory.

3 Shared Social Responsibility

The relationship between Sustainability Empowerment and its functional behavioral patterns should be analyzed within a Shared Social Responsibility model. The methodological analysis made here cannot be separated from the interconnection of the two concepts. Another important factor shifts the debate, integrating it in the territories, starting with the assumption that these last are privileged observatories to look at the actual applicability of certain paradigms of well-being and not only the place where the stakeholders physically move.

Starting then from the territory as fabric within which stakeholders daily perform more or less responsible actions, taking certain behavioral patterns, the analysis should be carried out taking into account the degree of responsibility that drives these behaviors, allowing or not an approach to Sustainable Well-being.

The business world, policies, support sectors, the media and consumers with their lifestyles, should not only act, but mainly deal in the context of a model of shared social responsibility.

In particular, the consumers' lifestyles changing that, as it has been previously stated, is function of a certain well-being paradigm, is possible only in view of a real application of the model of Shared Social Responsibility (Hertwich, 2005; Misso et al., 2013). In fact, this can only happen if all the stakeholders of the territorial

systems point simultaneously towards the goal of Sustainability Empowerment. How can they do it? In this regard it is very important the role of the media that should reset their information strategies looking to a new paradigm of Universal Well-being.

4 Social responsibility and Media

The current model of globalization imposes certain parameters to the Media from which you can hardly move. The current model of global governance largely influences information and communication that, today more than ever, comes strongly influenced to the consumers.

Certainly freedom of expression, understood as the ability to tell without filters, in some cases without retaliation, does not belong to that kind of information service offered by the most common media. This introduction is used to move the focus of certain info processes based not so much on the amount of provided service, but rather to the quality of it that strongly affects the aforementioned "freedom". To achieve Sustainability Empowerment, in a logic of social responsibility, information is more than ever a lever for change. Responsible communication, of which a certain type of information is the direct result, must be carried out in respect of all stakeholders through a service that is both educational as well as informative.

We need a new independent media who can contact their local stakeholders, a communication able to educate to new behavioral models compatible with the well-being and its sustainability. The strength of a so well thought communication should, find expression in the adoption by all stakeholders of those behavioral models related to sustainable attitudes.

In this sense, the function carriers to this type of communication that could be defined as independent are undoubtedly those relating to the "free" world of ICTs, especially the Internet. At this point it is important to understand how through the Internet it is possible to educate to the sustainability of well-being by promoting the principles of new lifestyles, bringing consumers to them, and making sure that they will later come to constitute the new "*demand for sustainability*".

5 Internet and new Lifestyles for a Universal Right to Well-being Sustainability

Globalization has deeply changed the sensory perception, revolutionizing the spatial-temporal standard criteria for all inhabitants of the planet.

The advantages of the so-called "global village" (Mac Luan) reside in the immediacy of information that knows no boundaries. The disadvantages are identified with the centralization of an information flow strongly mediated by the global governance. Hence, it follows that the traditional mass media such as newspapers, radio and television stations are essentially governed by those that hold power. Except for a few networks that are more sensitive to social issues and to the

environment one, the vast majority of the products packed by the standard information are affected by this pressure.

Quite different is the case of ICTs, especially the Internet, which have completely revolutionized the way we communicate by giving not mediated information. The power of ICTs and of the "liberty" of these instruments, also involves the interests of the big powers that constantly rely on the "immediacy" of Social networks. Internet (and all its extensions) is the main tool of global communication, so it responds perfectly to the type of support that suits the paradigm shift. For its "free" nature it is the absolute best way to communicate to consumers the importance of new lifestyles (Andreopoulou et al, 2014). Coming directly to consumers, the produced information flow is not affected, lending itself perfectly to the packaging of "pure" contents.

The network is the tool that most lends itself to the implementation of a Bottom Up strategy: an integrated communication able to fully express all the necessity of Sustainability Empowerment, it must necessarily adopt instruments capable to tell and to intervene on a reality more compatible with the well-being.

In other words, the Internet is actually that famous fourth estate, acting as a forerunner to a communication able to impact significantly and responsibly on the users' way of life.

5.1 Internet and Well-Being Sustainability: "The Portal of Sustainability", a Case Study

The Simone Cesaretti Foundation, adhering to the notion that the Internet is the right tool to communicate a certain paradigm of sustainable well-being, has designed and put on line "The Portal of Sustainability" (www.portaledellasostenibilita.it): a website with the aim of promoting the culture of Well-being Sustainability.

Adopting the model of Shared Social Responsibility, the portal aims to contribute to the dissemination and implementation of lifestyles compatible with a functional integrated well-being paradigm to Sustainability Empowerment.

Assuming that all stakeholders often do not have the tools, resources and information to implement independently certain behavioral models compatible with sustainability of well-being, the portal stands as vehicle construction, dissemination and promotion of responsible guidelines related to the Sustainability Empowerment.

Of course this cannot happen if the stakeholders are not contextualized in a Sustainability Oriented Territory — a place where the model of Shared Social Responsibility is really applied.

In particular, the consumer may not adapt his lifestyle to sustainability criteria without the support of a territory and of a context *already, in itself, sustainable*. The same consumer will hardly be able to parameterize his lifestyle on the principle of Sustainability Empowerment if the communication does not intervene to direct his sustainability choices. From this point of view, "The Portal of Sustainability" represents a web interface with an offer of contents suitable to determine the creation of a *Demand for Sustainability*.

6 Internet for New Food Lifestyles

"The Portal of Sustainability", as promoter of new lifestyles compatible with Sustainability Empowerment devotes a particular section to food. The current offer of goods and services, although wide, is often incompatible with the principle of food sustainability, at first against the segmented approaches to well-being (health), then against the entire paradigm. The offer raises the consumer confusion and inability to make critical choices. With respect to the latter consideration, which is contextualized within the model of Shared Social Responsibility, it can be said that it becomes essential for the Food Matter to pass from the current "Right to Food" to the "Right to overall food system". This means that the Food Systems of the planet must make a Right to Overall Food System compatible with the multidimensional nature of well-being and its sustainability, so that we come to a universal approach to food for sustainability and not just food.

This would lead the transition from segmented approaches (social, generational, territorial, eco-centric and anthropocentric) to the integrated Right to Overall Food System, in which, in fact, converges all the sustainable aspects of all segmented approaches.

"The Portal of Sustainability", believing the Food System an area of great importance for Sustainable well-being, has dedicated a section to new lifestyles to steer users toward a new Paradigm of Sustainable Well-being.

6.1 The Short Supply Chain as a reference for sustainable food styles

The underlying values the concept of short supply chain represent a value system of reference for food patterns that are compatible with the goal of Sustainability Empowerment.

These are models of life followed by critical consumers who usually inform themselves about the production process of a certain food, imagining a limited sequence of steps. The emblematic nature of Short Supply Chain translates the phrase "from producer to consumer" — referring not only to organoleptic features of the product but also to aspects of space and time. Indeed, today more than ever, the concept of Short Supply Chain became a symbol not only of a new way "to provide food" but above all a new approach to food, a way to retrieve the relationship of trust with those who create that agro-food product (and therefore not only agricultural) and, in a situation of economic crisis, a means to reduce the multiplication of the intermediation cost (AA.VV., 2005; Aguglia, 2009).

The concept of Short Supply Chain, then, went extending beyond the mere consumer-producer relationship to become the symbol of new patterns and habits that are going to require more economic, social, environmental, territorial and generational sustainability[2].

[2] An example of Short Supply Chain can be one type of "sustainable farmhouse" which, through an offer compatible with the criteria of Food Sustainability fully complies the Integrated Approach to Food. It is believed that the critical consumer frequenting a

7 Conclusions

Wanting to pursue the goal of Sustainability Empowerment it is necessary to change the current approach to well-being. To this end, it becomes necessary a crucial paradigm shift able to project the "*Global Society System*" by a segmented approach to well-being to a universal approach. If the *"Global Society System"* would adopt a new paradigm of well-being, this would have compatible lifestyles with the goal of Sustainability Empowerment that actually would become those concrete actions, based on criteria of sustainability. In this way you would identify lifestyles with that objective parameter to evaluate the actual degree of "sustainability" of a territory, in which should necessarily be applied a model of Shared Social Responsibility.

In this work we have given more significance on implementing a portal that among the various areas of the wellbeing, has planned a large section dedicated to food, focus on those food lifestyles compatible with an integrated approach to well-being and in particular on the corresponding reference models as the Short Supply Chains.

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"sustainable farmhouse" try to find, from his point of view of food, to arrive near the source, as close as possible to the product. Thus this critical consumer reports a lifestyle characterized from the Food sustainability, well aware of how the production cycle can intervene on the "sustainability" of the final product.

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Bird Watching and Ecotourism: An Innovative Monitoring System to Project the Species of Lesvos Island to Potential Ecotourists

Chryssoula Chatzigeorgiou[1], Ioanna Simelli[2], Apostolos Tsagaris[3]

[1]Department of Agricultural Technology, Alexander Technological Educational Institute of Thessaloniki, Greece, e-mail: chrxatz@farm.teithe.gr
[2]Management of Information Systems, University of Macedonia, Greece, e-mail: ioanna.simeli@gmail.com,
[3]Department of Automation, Alexander Technological Educational Institute of Thessaloniki, Greece, e-mail: tsagaris@autom.teithe.gr

Abstract. Ecotourists have high potentials to spread ecological awareness, while they maintain quality tourism and learn how to respect and preserve the natural environment. Knowledge is an important prerequisite to predict future attitudes and connect tourists with nature. Ecotourism focuses on areas with rare flora and fauna. Lesvos Island hosts rare species which attract numbers of bird watchers yearly. The current paper presents an innovative system that may record the movements of the birds and transmit the data to a mobile application available to potential tourists.

Keywords: birdwatching, ecotourism, innovation, Lesvos.

1 Introduction

Lesvos Island has been known to birdwatchers for the presence of two rare species: Sitta Krueperi and Emberiza Cineracea. The great variety of wetlands as well as its location in Eastern Meditteranean make Lesvos Island a unique destination for birds. Thus, Lesvos has the richest bird fauna of all the Aegean islands. Greece in general hosts around 449 bird species, more than 300 of which have been observed on Lesvos Island (Dudley, 2015).

Ecotourism can improve and disseminate the nature and culture of an area while it can be divided into active and passive ecotourism. Active ecotourism is when people try to improve or save the environment and make it healthier, but passive is considered when person wants to relax and seeks to minimize to damage the area. In short, ecotourism contributes in the interaction between humans and nature and help to acquire much awareness and understanding of the area, plus it helps to improve peoples' attitudes and behaviors towards natural environment (Cini et al., 2015).

Moreover the bio-cultural information should be provided to all people who take part in it. Within this framework, an innovative system is proposed to monitor the

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activity of the birds on the protected area. A network of wireless cameras is set to capture the usual or the migrating movements of the birds and simultaneously upload the data on an application allowing the registered users to comment on the picture. Furthermore, the users will be allowed to upload their own pictures from birds they watch so as to either be approved as a rare bird after the review of the Lesvos Bird Records Committee (Hellenic Rarities Committee, 2009) or accept the comments of the other users.

2 State of the Art

2.1 SCADA Systems

The suggested platform consists of a Supervisory Control and Data Acquisition (SCADA) system for the collection of the required information. SCADA systems collect data from sensors, communicate the acquired data, present them and finally use them mainly on the supervisory level (Daneels & Salter, 1999). Wireless sensors are used in numerous scientific fields like agriculture, nursing, medicine etc (Rehmann et al., 2014; Huang et al., 2014; Zhang et al., 2014).

Should the collection of data, in order to assess the performance of a system, is not an option, SCADA systems become useful and while, in the beginning, they were considered as a technical engineering tool, they eventually evolved to a key tool for decision makers within organizations. Among SCADA capabilities, the one that stands out is that they control complex processes without the need for specialist human resources (Asgarkhani & Sitnikova, 2014).

In technologically advanced countries, particularly the USA and countries of Western Europe, the need for monitoring parameters associated with environmental quality characteristics and especially the quality of water has been extensively recognized. For this purpose, several programs of automatic measurement of qualitative characteristics and analyses of results have been installed, which help in the development of agriculture (Gross Kopf William, 2001).

Supervisory Control and Data Acquisition (SCADA) systems are being widely used in agricultural applications and specifically in irrigation management systems, where an intelligent use of the water is required. Molina et al (2014) propose an application developed with LabVIEW graphical programming language, complex mathematical models for irrigation, data sampling. The use of a data acquisition card for collecting data from transducers and for the activation of the actuators makes it possible to apply the implemented platform both to a real irrigation system and to the developed scale model, supplying the students with a more practical application of the learned concepts. At the same time an educational platform for the design of SCADA applications for irrigation programming combined with a scale model of a trickle irrigation system is proposed from the researchers.

Vera-Repullo et al (2015) provide a SCADA system to optimize irrigation using weighing lysimeters in a potted crop. The software was programmed in a compact

embedded controller using the LabVIEW graphical programming language with the Real-Time module. This controller receives data from the lysimeters throughout a Modbus/RS-485 communication network, processes them and realizes the calculations to control the irrigation valves in real time.

Tsagaris and Hatzikos (2014) propose an innovative system that monitors and controls the water quality, both surface as well as groundwater and sea. Developed using the PLC and SCADA technologies, it is a sophisticated way to provide timely and reliable information and it is a necessary tool for public services, local authorities, scientific institutions and private companies that manage, control and / or use any form of water resources such as lakes and watersheds, rivers or streams, sea and groundwater. The system monitors the environmental, hydrological and meteorological conditions in real time with a wireless communication system for instant information and timely anticipation. It consists of a local control station located in the field of interest, which hosts various sensors for measuring water quality and meteorological parameters and a data collection central station which collects sensor readings, stores them persistently, it allows users to visualize, and finally regulate and receive alerts when certain metrics exceed some predefined limits.

2.2 Ecotourism - Bird Watching

Ecotourism has not yet been clearly defined. A number of studies were conducted in order to come up with a definition widely accepted. It is an alternative form of tourism (Fennell, 2008) focusing on the need for "clean"environment, alternative form of holidays linked to nature, that respects the local hosting community's needs.

The typology of hardcore ecotourists frames tourists with special interests oriented to nature and ecology (Fennell, 2008). The most common form of ecotourism is the observation of flora and fauna (birdwatching is part of this observation), visiting national forests etc (Chatzigeorgiou, 2009).

Ecotourism develops in areas of spectacular beauty and wealthy natural resources. It is directly linked to sustainability since the preservation of the environment, the culture and the community of every area are the pillars of ecotourism development (Hall & Boyde, 2005).

The island of Lesvos is the 3rd biggest island of Greece located on the NorthEastern Aegean Sea. The Gulf of Kalloni is one of the two main gulfs of the island where there are many wetlands and a "house" of rare birds. Alykes wetlands, when flooded, are a real magnet for birds and birders. 332 species have been recorded from the island as at 31 December 2014 while there are species of dragonflies and butterflies, rare reptiles and amphibians, and mammals. Finally, Lesvos is an island with explicit flora and rare orchids (Dudley, 2015).

Like other bird populations worldwide, there are birds on Lesvos island that are at risk of extinction and their conservation relies heavily on protected area networks. Ecotourism to these areas generates revenue to contribute to the species' conservation (Steven et al., 2013). Limited research has been carried out on the impact of tourism on bird populations, whereas extensive discussion has been devoted on sustainable development (Collins-Kreiner et al., 2013).

To sum up, the typology of bird watchers according to Vayanni et al., (2005), is people of middle age, well educated, individual tourists who spend more money than an average tourist and whose main concern is the preservation of the environment.

3 Proposed System

The paper proposes the implementation of an environmental monitoring network, which will monitor the environment of the target area, capture the movements of the birds, update the records of rare birds and simultaneously upload the pictures captured to a database available to any potential visitor of the area. At the same time, visitors will also be able to upload their own pictures to the database so as to submit them for approval by the LBRC.

The proposed system includes the installation of a network of wireless cameras in combination with meteorological stations. The cameras' objective will be the recording of the birds' activities in the protected area while the stations in combination with the hydrological stations will gather data concerning the environmental conditions of the area. In addition to the aforementioned elements, an elearning platform will contribute to informing the potential tourists on the climate, environmental conditions applied at the time in combination with the presence of the species in the area. The ultimate goal of the system is to gather data on the presence of the birds, upload them on the system so as to provide immediate information to potential tourists. Furthermore, given the lack of information to bird watchers, the immediate availability to a mobile application will allow the tourists to be constantly updated on species' movements, whereas the Lesvos Bird Records Committee will immediately be updated so as to approve or reject the record.

The network consists of (a) several Local Monitoring Stations (LMSs) which record and transmit data to the main station and (b), the Main station (MS), which initiates the communication process with all LMSs and stores the data in the database for future processing.

The Main Station (MS) includes a) all the necessary electronic telemetry hardware that enables the central system to communicate wirelessly with all the LSMs, either automatically or on user's command. b) the software for the safe recording, storage, presentation and management of measurements and monitoring for excessive environmental parameter values (alarms). c) Necessary hardware and software for remotely accessing and managing the MS.

The local stations collect all hydrologic and air indices like water ph, water temperature, dissolved oxygen, conductivity, turbidity, chloride, nitrate and ammonium ions, chlorophyll, direction and air speed, air temperature and humidity, sunlight, rainfall e.t.c. The sensors come from various international vendors with RS232 and analogue output ports (Fig. 5).

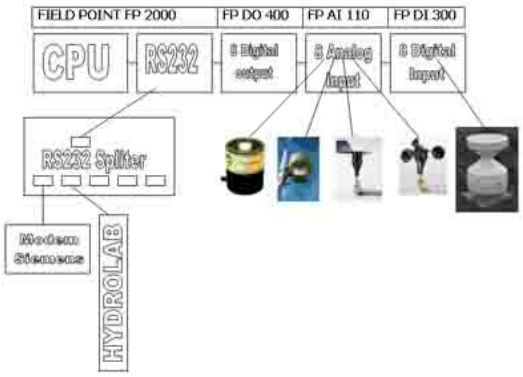

Fig. 1. Connecting sensors with the central unit of the local station (Tsagaris & Hatzikos, 2014).

An important point is that the system is connected to the batteries that are installed in the LSM that cover the complete and continuous operation of telemetry system. The port-to-port response time of the system is negligible. The communication of the LSMs with the MS is performed through mobile telephony (GSM technology).

3.1 Network Topology

The cameras will be placed to spots indicated by the Hellenic Ornithological Society whose contribution is of utmost importance. The conjunction of image capturing with central gathering points will be accomplished with the use of wireless links. A wireless link will also be used for the connection of any intermediate spot with the central station. All the points of image capturing will communicate with the use of directional antennas to guarantee the required communication speeds and the protocol used will be Ethernet TCP/IP.

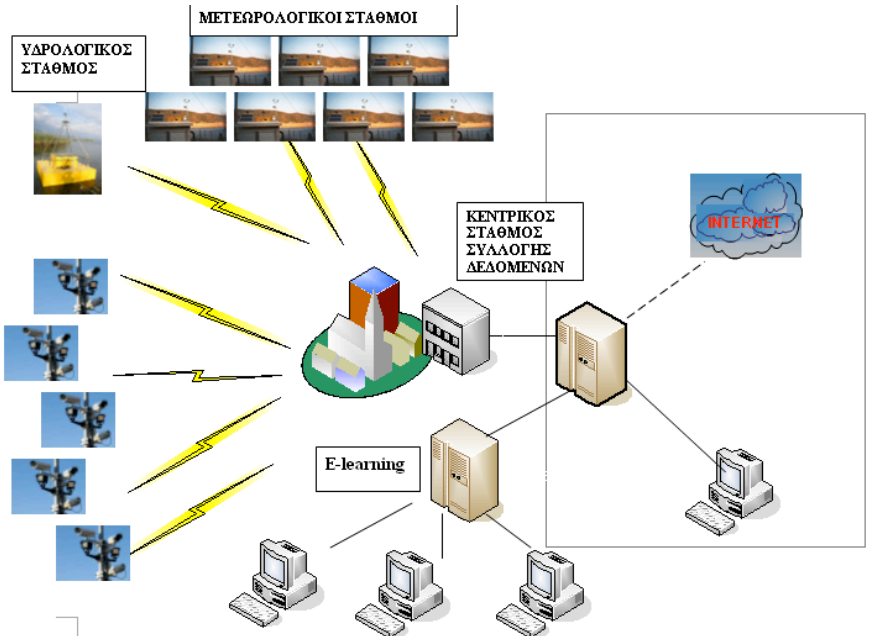

Fig. 2. Network topology.

3.2 E-learning Platform

Nowadays, users not only do they seek the information but rather participate in its creation (wikis), comment (forum, blogs, micro blogs), create networks with common interests (social networking), cooperate (collaborative networks), they are trained (e-learning) in combination with traditional learning (blended learning), they entertain with videos (youtube) and pictures (flikr). This is the new face of the evolving network (Web 2.0)

The e-learning platform will include learning objects, which will be compatible to SCORM standard and communicate user data and performance data i.e. user id, pictures uploaded by the user, user's records accepted by LBRC etc. Users will be trained to interpret the data collected by the stations like wind speed, waterfall, bird movements, threats etc.

The educational material will be accessible to all users and it will record statistical info on its use by visitors in order to evaluate and upgrade the platform.

4 Discussion

Ecotourism is an alternative form of tourism, which focuses on the preservation of the environment and the sustainable development of an area. Lesvos island is a well-known island for the development of alternative forms of tourism and the rare flora and fauna present on the area. Bird watchers flood the area in springtime looking to record views of rare species.

On the other hand, records aren't approved or rejected on time. It needs to be highlighted that there are records that haven't yet been examined since 2013.

Thus, there is a need for online information and education on the area's exceptional natural environment and provide instant update on the presence of rare birds.

Technology can contribute to satisfy the above-mentioned needs of all interested parties.

The system described in the current paper benefits scientists - ornithologists who visit the area to observe the birds, environmental associations, students, potential tourists, ecotourists and visitors in general, local authorities. Their benefits can be grouped in:

- understanding the unbreakable relationship between the human and nature and their interaction
- sensitizing the public in environmental education
- documentation of rare species
- creation of a pillar of environmental education and research
- educating people on the rare flora and fauna of Lesvos island

Managerial implications

Such a system can contribute to decision making on a local or regional level regarding the development of an area with environmental concerns. Through the elaboration of the data gathered, important decisions can be made regarding the impact of the visitors on the area, the endangered species as well as the satisfaction of the visitors' needs. Lastly, the proposed system can heavily contribute to the environmental education in Greece and abroad via the online learning platform, which gives remote access to everybody interested in the area or ornithology.

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Assessing the Environmental Impact of Mountain Tourism. The Case of Elatochori Ski Centre, Greece

Stefanos Tsiaras[1]

[1]Department of Forestry, Aristotle University of Thessaloniki, Greece,
e-mail: stefanostsiaras@gmail.com

Abstract. The development of mountain tourism in Greece is a recent phenomenon and one that has been affected by the economic crisis. Key factor to its development was the ski resorts that spread through the country especially in the last twenty years. The present paper focuses on a ski resort in Greece, Elatochori Pierias, attempting to assess the impact of mountain tourism on the sustainable development of the area. Apart from the obvious economic benefits, the ski resorts have negative impact on the environment and the society. Therefore, ski resorts cannot be characterized as sustainable according to the spirit of the three pillars of sustainability.

Keywords: mountain tourism, sustainable development, environmental protection, ski centre, Greece

1 Introduction

Mountain tourism has gained popularity over the last years in Greece, especially through the development of ski resorts all over the country.

According to Butler (1993), sustainable tourism was a key concept for the researchers since the early 1990s. Although there is broad consensus that tourism development should be sustainable, the way of achieving this is an object of debate. (Gössling et al., 2005).

The development of mountain tourism has been mentioned by several researchers (e.g. André, 1998; Godde et al., 2000) as a way to reinforce the income of the residents in mountainous areas, because the traditional practices (agriculture, livestock breeding and forestry) were not profitable enough. The development of ski resorts was a key factor in the development of mountain tourism in Europe (Moser and Moser, 1986; Price, 1987; Laguna and Lasanta, 2001).

Tourism development has both positive impacts, such as job creation and income raise, as well as negative ones, especially on the environment and the society (Zhong et al. 2011). The operation of a ski resort in an area has many benefits, such as economic growth, improvement of services and infrastructure and the feeling of positive psychology among the locals (Snowdon et al., 2000; Lindberg et al., 2001). A population increase is also observed (Daumas, 1986), along with a decrease of the average age of the population (Buckley et al., 2000; Pechlaner and Tschurtschenthaler, 2003), since residents from nearby areas (especially young

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people) relocate in order to take advantage of the job opportunities offered as a result of the development of a ski resort. On the other hand, there are also consequences such as environmental decline (Needham and Rollins, 2005), landscape change (Pignatti, 1993), social conflicts (Tooman, 1997; Weaver and Lawton, 2001) and cultural decline (Jamal and Getz, 1999; Billet, 2003). Moreover, special aspects of mountain tourism, such as seasonality of visitors and environmental fragility, render mountain areas more vulnerable compared with other tourism destinations (Geneletti and Dawa, 2009).

While it is broadly accepted that sustainable development relies on three pillars: economic growth, environmental protection and social progress (Gibson, 2006; Murphy, 2012), most researchers focus on short term benefits connected to the pillar of economy, ignoring environment and society (Drexhage and Murphy, 2010). It is only recently that the importance of environmental protection in sustainable development has been pointed out (Muntean and Cunglesan, 2008; Dogaru, 2013). The environmental impact of tourism has been widely studied in countries such as the United States of America, the United Kingdom and Australia (Pickering and Hill, 2007). In many mountain regions, the environmental impact of tourism is critical, because of the lack of infrastructure (Singh and Mishra, 2004).

The aim of this paper is to assess the environmental impact of mountain tourism in a ski centre in Greece, Elatochori Pierion. Although the paper focuses on the environmental pillar of sustainability, the pillars of economy and society are also examined.

2 Materials and Methods

Study area

The study area is Elatochori, a mountain village in Northern Greece, which gained popularity over the last years as a mountain tourism destination. The ski resort in Elatochori that started operating in 2001, played a crucial role in that development. Apart from mountain tourism, the local population is involved with agriculture and livestock breeding.

The Elatochori ski centre is located in the north-east side of Pieria Mountains. Its distance from the second-largest Greek city (Thessaloniki) is 105 km, from Larissa 120 km and from Katerini 36 km. The altitude in the ski centre starts at 1.400 meters and ends up at 1.975 meters. The ski centre has ten (10) slopes of 13.800 m total length. Slope classification is presented in Table 1.

Table 1. Slope classification in Elatohori ski centre

Slope classification	Number of slopes	Total Length (m)
Green (Very easy)	4	6.750
Blue (Easy)	2	1.950
Red (Intermediate)	2	3.900
Snow board slope	1	500
Sledge slope	1	700

The ski centre has five lifts (aerial double seat, two sliding lifts and two baby lifts) with a capacity of 1.200 persons per hour. The chalet can host 400 persons. Other facilities include snow bars, ski learning schools, ski equipment shops, first aid, and parking.

The ski centre facilities operate from December to March depending on the weather conditions. The average tourist season is from 90 days to 120 days. In Europe the "100-day rule" applies (König and Abegg, 1997; Elsasser and Bürki, 2002), meaning that a ski centre has to be open for at least 100 days per year in order to be profitable.

Methodology

Statistical data regarding the population of the study area and CO_2 emissions by vehicles were collected from the Hellenic Statistical Authority (EL.STAT.). Pertinent data on the Elatochori ski centre were collected from local authorities (Pierion Municipality and Elatochori ski centre management). Indicators of tourism load (number of tourist beds in the study area, Defert's Tourist Function Rate) are used in order to assess the impact of mountain tourism.

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3 Results and Discussion

Mountain tourism has always been an expensive pastime. The average cost for a four-member family that arrives in the ski centre from the nearest city of Katerini and dines in the area is estimated at 100 €.

Indicators of tourist load refer to: a) number of tourist beds in the study area and b) Defert's Tourist Function Rate (DTFR), first used by Defert (1967) and often used by tourism researchers (Smith, 1995; Laguna and Lasanta, 2003).

$$\mathrm{DTFR} = \frac{x}{y} \times 100 \qquad \textbf{(1)}$$

Where x is the number of tourist beds and y is the number of inhabitants in the study area.

The first hotel in the study area was established in 1998. Since the census in Greece is being held every ten years, the DTFR rate was used for the years 2001 and 2011 for comparison purposes.

Table 2. Population in the study area (Source: EL.STAT.)

Pierion Municipality	2001	2011
Population	2.547	2.085

Between the years 2001 and 2011, the population in the study area has dropped about 22% (Table 2). Similar reduction of population is observed in many mountainous, less favoured areas during the same period.

Table 3. Tourist indicators in the study area

Indicators	2001	2011	Percentage
DTFR	3	25	733,33%
Number of beds	86	520	504,65%

The last column indicates the raise % of each indicator in 2011, compared to 2001. Both tourist indicators show significant increase compared with the year 2001. Only ten years later, the Defert's Tourist Function Rate has increased by 733% and the number of beds has increased by 505% (Table 3).

Table 4. Comparison of ski resort prices between years 2009 and 2015 (€).

Year	2009	2015
Day ticket	15	11
Day ticket (discount)	11	8
Year card	150	120
Year card (kids)	100	80

The economic crisis in Greece has affected mountain tourism as all other sectors of Greek economy. The prices in the ski resort since the beginning of the economic crisis (2009-2015) have dropped at a range from 20% to 25% (Table 4).

In 1998, there was only one (1) hotel in the study area with 26 bed capacity (Tsiaras and Andreopoulou, 2015). In 2004, three years after the opening of the ski resort, the number of the hotels raised to eleven (11). In 2009, mountain tourism in the area reached its peak: Twenty one (21) hotels and accommodation units were available in the area, and the total bed capacity had greatly increased (159% raise compared to 2004).

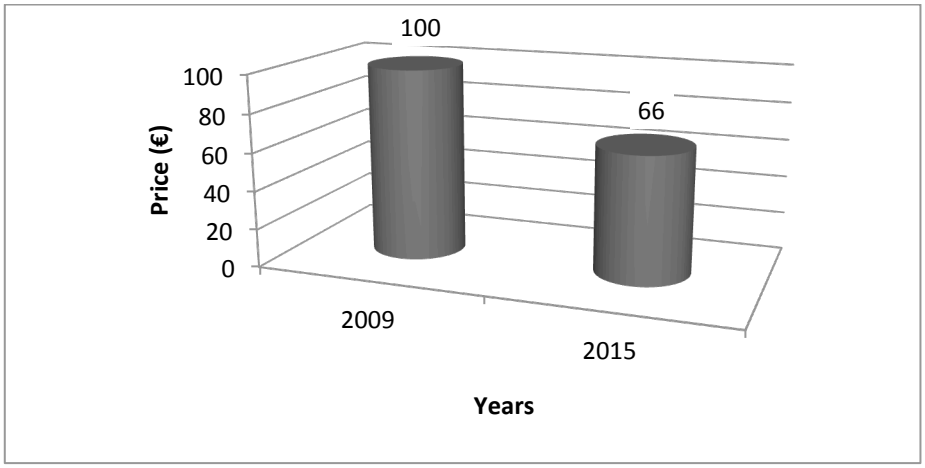

Fig. 1. Comparison of the average price of a two-bed room in the hotels of the study area between years 2009 and 2015.

Since then prices have been reduced by 34% (Fig. 1), as the economic crisis affected the price policy of the accommodation units. A significant price drop was deemed the only way to survive.

Gross income from touristic activities in the area is assessed around 2.000.000 € per year. The aforementioned number was assessed by calculating the average occupancy rate of the hotel, as well as usual patterns regarding dining, shopping etc. The average occupancy rate per year is estimated at 30% (personal research). Gross income was about 2 to 3 times larger before the crisis.

Table 5. Assessment of the impact of mountain tourism in the study area based on the three sustainability pillars

Sustainability pillar	2000	2015
Economic Growth	S1	+
Environmental Protection	S2	-
Social Equity	S3	+-

Table 5 shows the evolution of the sustainability pillars between year 2000 (base year) and the present situation (year 2015). In order to describe this evolution, plus (+) and minus (-) signs are used .The economic growth of the study area generated by tourism is obvious, although the economic crisis has affected the rate of this growth. At the same time, an environmental decline is observed. According to Elatochori ski centre management, more than 90% of the visitors arrive at the ski resort by car; this was verified through personal research (Tsiaras and Andreopoulou, 2015). As a result, the transportation of the tourists causes a major environmental pressure, due to a high amount of CO_2 emissions. Taking under consideration the average tourist

arrivals in the area per year, CO_2 emissions are estimated at around 195-210 tn per year (Table 6).

Table 6. Total CO_2 emissions by transportation in the study area (year 2014)

CO_2 Emissions	Distance covered	Number of cars	Total emissions
195-210 g / km	50 km	20.000	195-210 tn

Total CO_2 emissions by vehicles in the study area, shown in the fourth column, are estimated by multiplying numbers in the first three columns of Table 6 (CO_2 emissions*distance covered*number of cars). Average distance covered per vehicle moving within the area is estimated at about 50 km (personal research). The number of cars for the year 2014 has been estimated taking under consideration the average tourist arrivals in the study area (data collected through interviews conducted with hotel owners and the ski centre management).

Obata et al. (2005) outline the necessity to preserve the environment with the sustainable use of resources. Therefore, the local authorities should seek measures to reduce that number either by embracing more green ways of transport or by raising forested area in order to absorb more CO_2 emissions.

Agrotourism based business contribute to income improvement of the locals. However, when economic enlargement is its exclusive goal there is no space for sustainable development (Lasanta et al., 2007).

4 Conclusions

There are certain economic benefits that satisfy one pillar of sustainability (economic growth), but at the same time, there are major environmental consequences that affect another pillar of sustainability (environmental protection). The third pillar (social equity) is affected in a complicated way: on the one hand people involved in tourism based businesses are highly benefited by the ski centre and on the other people involved in the primary sector of production are negatively affected. Taking that into consideration, it can be concluded that the ski centre of Elatochori does not contribute to the sustainable development of the area according to the spirit of Brundlant Report (1987).

The economic crisis that caused the collapse of Greece economy during the last years, has also affected the tourism in the study area. More specifically, during the crisis eight hotels were forced to seize their function, while the number of the bed capacity in the area has dropped in the half (51% reduction). The losses for the tourism related business are estimated in two million euros (2.000.000 €). Tourism related business were forced to reduce prices for their services at percentages that vary from 20% up to 35%, compared with the prices in the year 2009 (the beginning of the crisis).

The competitive relation between tourism and primary sector of production has been pointed out by researchers all over Europe (Oberacher, 1995; Snowdon et al.,

2000). Lasanta et al. (2007) conclude that ski resorts benefit only a restricted area; because of their negative effects in the primary sector, land management, environment and society, the strategy of the development of mountain tourism with the development of ski resorts is unsustainable in the medium term. A recent study (Strom and Kerstein, 2015) provides an exception to this rule: in Ashville, North Carolina, USA, sustainability of the tourism growth was achieved through mutual conciliations among all the interested parties: residents, industry, local authorities, focused on common benefits. Since sustainable development in mountainous areas is a difficult and complex task, Tzanopoulos et al. (2011) propose a combination of sustainability assessment and scenario analysis in order to achieve sustainable development strategies.

Tourist destinations affect the lives of the residents both positively and negatively at the same time (Jurowski et al., 1997). A fundamental condition for the integrated development of mountainous areas is the correct use of the local advantages of the area (Soutsas et al., 2006), taking in consideration the crucial role of the local society in sustainability (Abaza and Baranzini, 2002; Uphoff, 2002). It is obvious that the ski centre in Elatochori has a positive economic impact in the area. However, it is also evident that it has a negative environmental impact. The local community should decide whether the economic growth, the environmental protection and the social equity can coexist and to what extent.

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Greek Public Tertiary Education Departments of Agriculture

Giannoula Florou[1], Sofia Anastasiadou[2], Anastasios Karasavvoglou[3], Stavros Valsamidis[3], Athanasios Mandilas[3]

[1]Department of Accountancing and Finance, EMaTTech Institute of Technology Ag. Loukas, Kavala, Greece, e-mail: gflorou@teikav.edu.gr
[2]School of Pre-School Education, University of Western Macedonia, 3o Km Florinas Nikis Florina, Greece, e-mail: sanastasiadou@uowm.gr
[3]Department of Accountancing and Finance, EMaTTech Institute of Technology Ag. Loukas, Kavala, Greece

Abstract. In this paper, we analyze the students' preferences regarding the institution (university or technological institute) for studying agriculture. Our focus is on the departments of higher or lower preferences and our aim is to study the influence on these preferences of factors as department's geographical position or its age. Using descriptive statistic and multivariate data analysis methods, we comment on the distribution of preferences of high school graduates for the year 2007 until 2014 and the correlations with the variables mentioned. Our goal is to record the most popular university department as well as the department which failed to attract sufficient number of students. We hope our conclusions will be useful for planning the future of these departments.

Keywords: agriculture department, education, students' preference.

1 Introduction

The agriculture sector is an important part of Greek economy (Drakopoulos and Theodossiou, 1991; Camagni, 1995; OECD, 2010). A percentage of 13,6% of all employed people older than 15 years work in agriculture (Ereuna apasxolisis ergatikou dunamikou, 2015). This is the second high percentage. (The percentage for trade is 17,7% and 9% work in transformation sector). Many years ago, an individual decided to become a farmer because his father was a farmer as well. There was no need for education. He had experience in agriculture and he thought that was enough.

In the graph we present how many people over 15 years old were employed in agriculture from 2001 until 2014 in Greece. After 2004, about 100 thousands have left agriculture. In 2014, 480.400 persons older than 15 years were active in agriculture. This number was almost the same in years 2011, 2012, 2013 and 2014.

The percentage of people in agriculture of the total working people has arisen after 2009. In 2014 the percentage was 13,6%. As people in agriculture decreased and

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unemployment increased in the other sectors, a cause of economic crisis (after 2009), the percentage of people employed in agriculture mounted (Bank of Greece, 2014). Agriculture is a sector almost without unemployment (Ereuna apasxolisis ergatikou dunamikou, 2015).

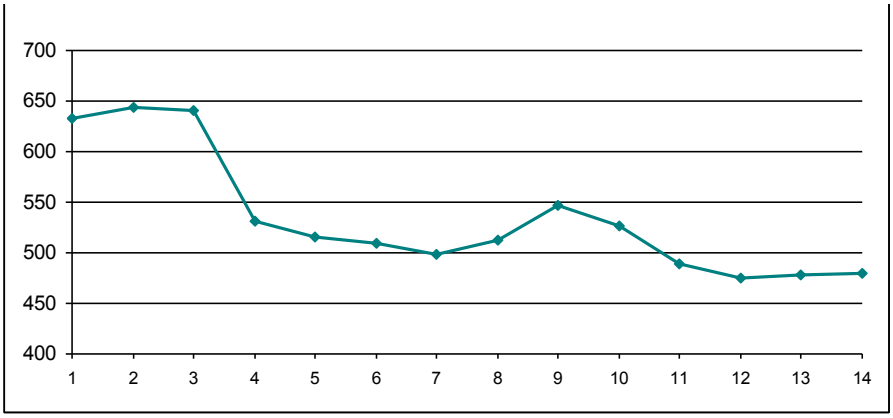

Fig. 1. Number of employed (thousands) per year

In table 1, it becomes evident that only 1 out of 4 workers in agriculture have completed secondary education, while 18% have completed 9 years of primary education and 47,3% have completed the 6 years of primary education. Only a percentage of 4% of workers in agriculture have graduated from tertiary education.

Table 1. Education of people in agriculture

2014	Tertiary education	Completed post secondary technical-vocational education	Completed secondary education	Completed the third grade of 6-year secondary education	Completed primary education	Have not completed primary education
total	3,7%	2,9%	26,8%	18,1%	47,3%	1,6%
men	4,3%	2,6%	28,0%	21,0%	42,4%	1,7%
women	1,8%	3,2%	25,1%	13,8%	54,7%	1,5%

In recent years a lot of young people have decided to acquire agriculture-related education in order to work in agriculture. Some of them want to be expert in agriculture and help the others by introducing to them new technological methods. In major Greek cities (Athens, Thessaloniki) there are agricultural departments in universities and in technological institutes. There are also agricultural departments in other smaller towns.

We use data of candidate students in these departments from year 2007 until 2014. Our objects in this paper are to:

- Analyse the demand of such field of education over the last few years.
- Present the preferences of first-year students.
- Find the most popular Greek agriculture departments.

Check if economic crisis has changed candidates' preference in agriculture education.

2 Greek Agriculture Education

The Greek tertiary education is divided in two parallel sectors, Universities and Technological Institutes (DOATAP, 2015). After completing secondary education, candidate students take exams (named "panellinies") in order to succeed in being admitted in only one department of University or Technological Institute. These exams are the same for all candidates in the country. The government determines the number of students (places) in each department and the questions for the exams (Minedu, 2015).

After the exams, candidates submit their preference for faculty. If they have good ranking in the exams, they manage to enter the department of their first preferences, if there are available places in this department. If there are no places available they may be admitted to another department of their next preference.

There are 13 agricultural departments at Universities and 20 at Technological Institutes. The candidate numbers are shown in figure 2 (first graph for University departments in other towns and second for University departments in Athens). It becomes evident that the number of candidates has increased after 2011 in every agriculture department. Especially candidate numbers have increased in the department (code 273) of Thessaloniki reaching 8000 candidates.

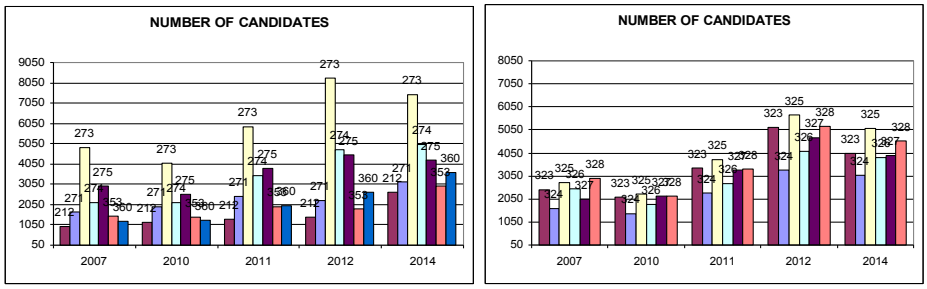

Fig. 2. Candidates per year at university departments

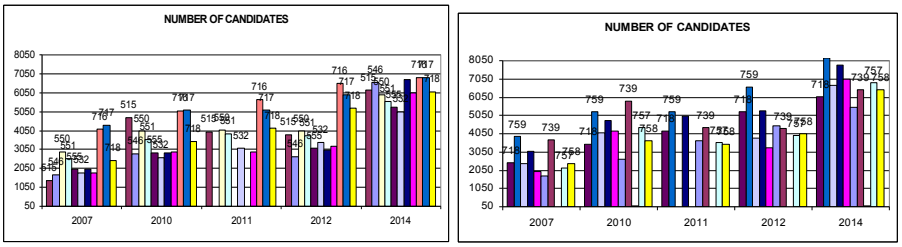

Fig. 3. Candidates per year in departments of Technological Education Institutes

3 Number of First-year Student

The number of first-year students is determined by the government. In figures 4 and 5 the numbers of first- year students in University departments and Technology Institute departments are depicted. The great increase in all departments in 2014 is clearly perceived.

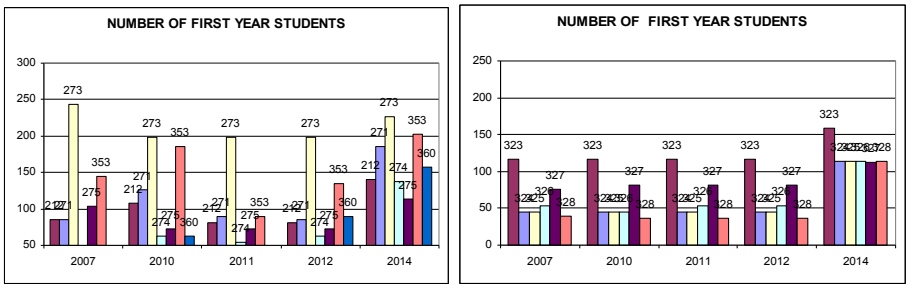

Fig. 4. Number of first- year students per year in university departments.

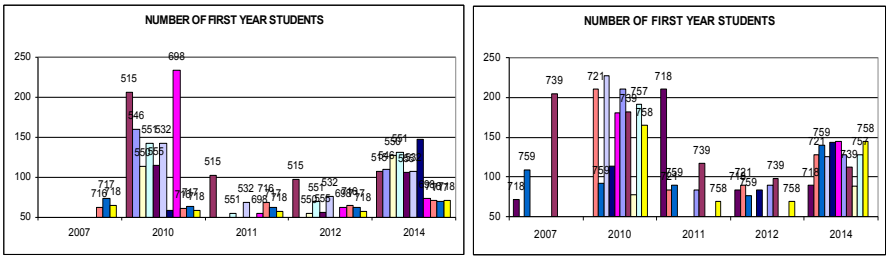

Fig. 5. Number of first-year students per year in Technological Education Institute departments.

4 Percentage of Successful Candidates and Preferences

The percentage of candidates, who succeed in the exams and enter agriculture university departments, is about 5% (Figures 6 and 7).

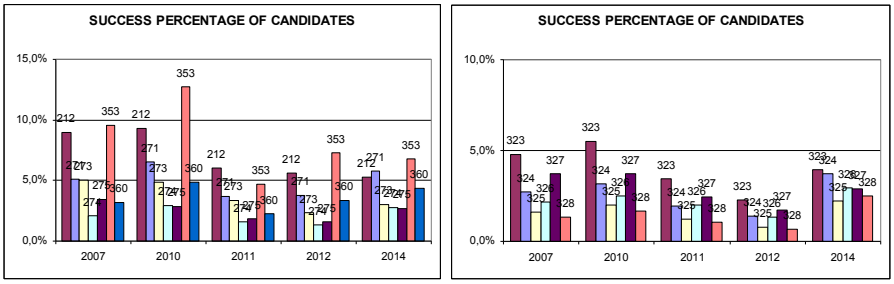

Fig. 6. Percentage of candidates, who succeed in university departments per year.

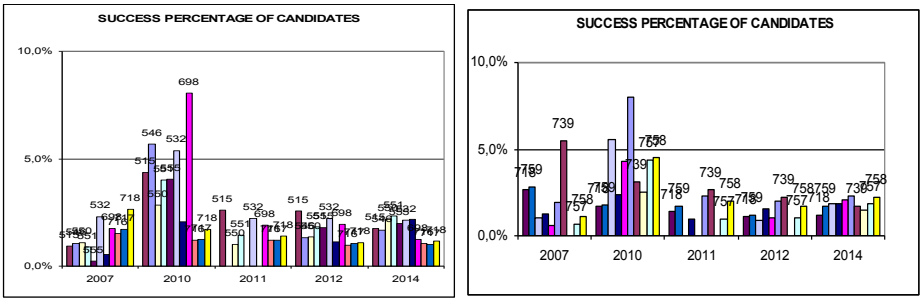

Fig. 7. Percentage of candidates per year, who succeed in Technological Education Institute departments.

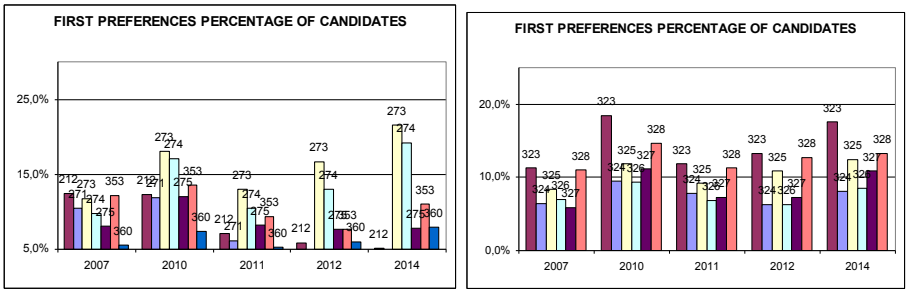

Fig. 8. Percentage of first preference of University departments of candidates per year.

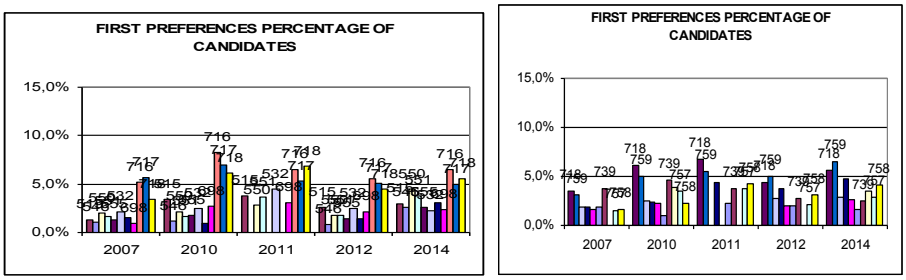

Fig. 9. Percentage of first preference of Technological Education Institute departments of candidates per year

The percentage of candidates who select university departments in first, second or third order of preference is from 10% to 15%.

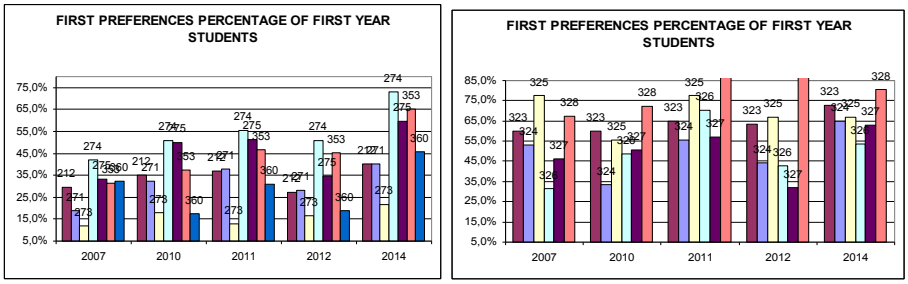

Fig. 10. Percentage of preference for University departments of first year students per year.

However, for the successful first year students, the percentage of those who expressed preference (first until sixth) was from 60% to 80% in 2014. Only three university departments (code 273-Thessaloniki, code 212-Orestiada, code 271-Agrinio) have a percentage of 25%-35% satisfaction of first year students.

The percentage of first - year students who had expressed preference (first until sixth) for the departments of Technological Education Institutes is about 30%-50% in 2014. Only three departments (code 716-Athens, code 717- Thessaloniki, code 758-Crete) have a percentage of 60%-80% satisfaction of first year students.

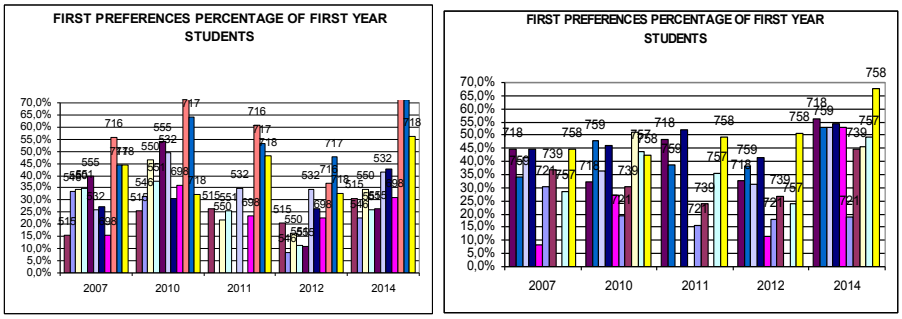

Fig. 11. Percentage of preference for Technological Education Institutes of first year students per year.

5 Influence of Economic Crisis in Agriculture Education

The ratio (percentage) of first preferences (1^{st},2^{nd},3^{rd},4^{th},5^{th},6^{th}) of first year students divided by the total number of first year students gives us the "satisfaction" percentage of first year students. This average "satisfaction" is shown in the table 2 per year. There is significant difference among years as we can conclude by analysis of variance (table 3).

Table 2. Percentage of satisfaction per year

YEAR	2007	2010	2011	2012	2014	total
Satisfaction %	37,5%	43,2%	47,0%	35,0%	51,0%	42,7%

In 2014 and 2007 the departments with the greatest satisfaction percentages are shown in the table 4. In 2014, the satisfaction is higher in more departments than 2007. In 2014 and 2007, the departments with the highest candidate numbers are shown in table 5. In 2014, the numbers are almost double than 2007. The departments with the highest candidate numbers are departments of Technology Education Institutes. The only exception is the Agriculture University Department of Thessaloniki.

Table 3. Results of Anova for successful percentage

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0,557	4	0,139	5,018	0,001
Within Groups	4,218	152	0,028		
Total	4,775	156			

successful percentage	year	N	Subset for alpha = 0.05	
			1	2
Duncan	2012	32	34,96%	
	2007	32	37,48%	
	2010	33	43,23%	43,23%
	2011	27		46,99%
	2014	33		51,01%
	Sig.		0,065	0,083

Table 4. Higher satisfaction percentages in 2014 and 2007

2014			2007		
Code	name	satisfaction	Code	name	satisfaction
328 (univ)	Food Science and Human Nutrition Athens	80%	325 (univ)	Biotechnology Athens	80%
716 (tei)	Food Technology Athens	72%	328 (univ)	Food Science and Human Nutrition Athens	70%
717 (tei)	Food Technology Thessaloniki	71%	323 (univ)	Crop Production Science Athens	60%
273 (univ)	School of Agriculture Thessaloniki	70%	716 (tei)	Food Technology Athens	55%
274 (univ)	Agriculture Crop Production and Rural Environment Volos Thessaly	70%	324 (univ)	Animal Production Science Athens	50%
323 (univ)	Crop Production Athens	70%	327 (univ)	Natural Resources Management-Agricultural Engineering Athens	50%
325 (univ)	Biotechnology Athens	70%			
353 (univ)	Argotic Development Orestiada Thrace	70%			

Table 5.The highest candidate numbers in 2014 and 2007

2014			2007		
Code	name	candidates	Code	name	candidates
759 (tei)	Agricultural technology Thessaloniki	8180	273 (univ)	School of Agriculture Thessaloniki	4835
761 (tei)	Agricultural technology Larisa Thessaly	7828	717 (tei)	Food Technology Thessaloniki	4339
273 (univ)	School of Agriculture Thessaloniki	7474	716 (tei)	Food Technology Athens	4134
762 (tei)	Agricultural technology Florina Macedonia	7025	759 (tei)	Agricultural technology Thessaloniki	3898
717 (tei)	Food Technology Thessaloniki	6843	739 (tei)	Food Technology Karditsa Thessaly	3715
716 (tei)	Food Technology Athens	6829			
757 (tei)	Agricultural technology Arta Ipiros	6822			
557 (tei)	Agricultural technology Amaliada Patra	6749			

6 Conclusions

In Greece, the agriculture sector is a big part of economy. A percentage 13,6% of all employed people older than 15 years old work in agriculture. The percentage of people in agriculture of all employed people has increased after 2009 when economic crisis began. In recent years, many young people decided to study in schools relevant to agriculture in order to work in agriculture. We have concluded that the candidates' numbers have doubled for some agriculture departments of tertiary education. The departments with the highest candidate numbers are the departments of Technological Education Institutes.

The number of first year students is decided by the government. There was a great increase in 2014 in all departments. The percentage of candidates who succeed in the exams and enter agriculture university departments is about 5%. The percentage of candidates who have chosen the university departments in first, second or third order of preference is about 10% -15%.

For the successful first year students, the percentage of those who had stated preference (first until sixth) was from 60% to 80% in 2014 for University departments. For the departments of Technological Education Institutes this percentage was from 30% to 50% in 2014. The departments with the greatest satisfaction percentages have changed from 2007 until 2014.

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Spatial and Temporal Data Analysis of Cephalopods Catches in Greece

Georgios K. Tegos[1]

[1]Information Technology Department, Alexander Technological Educational Institute of Thessaloniki, (A.T.E.I.TH), P.O. Box 14561, 54101 Greece, e-mail: gtegos@gen.teithe.gr

Abstract. Multidimensional Fishery Time Series database stores fishery time series data regarding different aspects of Greek fishery sector such as economical, technical, biological, space and time and it is used for carrying out sustainability and risk analysis of Cephalopods catch quantity in Greece. Economically the most important Cephalopods species Octopus seems to be sustainable for the last four years. Besides, Aegean Sea areas are more sustainable than Ionian Sea areas as it concerns biodiversity. This type of research gives the opportunity to study changes of catch quantities by species and by areas in time, which may constitute an essential tool to support decision making on sea fishery resources and related economical activities.

Keywords: time series database, sustainability, risk, biodiversity

1 Introduction

Human interest in Cephalopods is long standing. The classical civilizations of the Mediterranean had a good knowledge of the various types. Descriptions of Cephalopods can be recognized in Homer's Odyssey, Aristotle's *Historia Animalium, in* Minoan Crete and Greek and Roman cultures *as well*. Boyle and Rodhouse (2005). Cephalopods, as shown by drawings on Greek ceramics and the Aristotle's descriptions, were well known in Greece since the antiquity. Nevertheless available data concerning cephalopod fauna and biology were scanty prior to the 1990s. Despite the reduction in the quantity of cephalopods since 1996, their proportion compared to total production of marine fisheries continues to increase. Lefkaditou (2006). The share of total catch quantity of Cephalopods changes from 7 to 11% of total fish catch quantity for the period 2000-2011. Besides, the food quality of these species, especially Octopus, makes this group very important. Cephalopods exist in all marine habitats worldwide and provide a large part of the total global biomass of all marine. Clarke (1996). Scientific knowledge of cephalopod distributions and abundances is important to understand their contribution not only to ecological relationships but also to overall energy flow and transfer of materials. Piatkowski et al. (2001). Fishing pressure on marine biota has increased during the last decade. Data from the Food and Agriculture Organization of the United Nations (FAO) reveal no rise in marine catch during this period Valavanis et al. (2002) FAO statistics on cephalopod catch in the Mediterranean show no rise

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since 1988. Meaden and Do (1996). Data from the Greek National Statistical Service (GNSS) reveal the same pattern in cephalopod fisheries in the Eastern Mediterranean since 1994. FAO (2000). Since the early 90s, however, the distribution and abundance of cephalopods in the Greek Seas have started to be regularly monitored but the data have not yet been thoroughly analyzed D'onghia et al. (1992); Lefkaditou and Kaspiris (1996). The sensitivity of cephalopod species to environmental fluctuations is a potentially important factor to take into account in stock assessments and fishery management measures. It also suggests that cephalopods could act as indicators of environmental change and ecosystem conditions. Pierce et al. (2013). Evidence of overexploitation of fish stocks in the Greek seas is widespread and growing. In 2007, about 65% of the Greek stock was characterized as overfished, 32% as fully exploited and only 3% were characterized as developing; collapsed stocks were not recorded. It was concluded that the Greek fisheries are no longer sustainable and radical management measures are needed. Tsikliras et al. (2013). Ecological indicators calculated from landings data have been extensively used to evaluate the effects of fishing on marine ecosystems. However, few studies have tested the possible effects of gear and spatial aggregation of landings data on different ecological indices over a long-term period. Moutopoulos et al. (2014).

This paper aims to analyze spatial and temporal data on quantity of Cephalopods catch in Greece for the period 2000-2011. The issues of sustainability of catch quantities and risk analysis have a primary significance in this study.

2 Materials and methods

Multidimensional Fishery Time Series (FTS) database on fishery that is based on National Statistical Service database of Greece (NSSG) is the source of data for this study. FTS database stores fishery time series data regarding different aspects of Greek fishery sector as follows:

- Economical – Quantity of catch, Value of catch, Employment, Category
- Technical – Kind of fishery, Fishing tool
- Biological – Fish group, Fish species
- Space – Country, Fish area
- Time – Year, Month.

	Area_Code	Name	Measure
+	106	Gulf of Kyparissia and Gulf of Messinia	Metric tons
+	107	Gulf of Lakonia	Metric tons
+	108	Gulf of Argolida and Saronikos Gulf	Metric tons
+	109	Gulf of Korinthia	Metric tons
+	110	Gulf of S and N Evia-Gulf of Lamia	Metric tons
+	111	Pagassitikos Gulf	Metric tons
+	112	Eastem coasts of Evia and Sporades islands	Metric tons
+	113	Thermaikos Gulf and Gulf of Chalkidiki	Metric tons
−	114	Str. G.,G.of Kavala-Thassos and Sea of Thraki	Metric tons

	Year/FishSpecies	Flying squid	Common squid	Poulp	Cuttle fish	Octopus
	#2000	459,069	233,7203	525,736	545,5315	1272,47
	#2001	364,1	82,9	365,4	475,2	1216,8
	#2002	483,2	62,2	323,1	454,8	1454,5
	#2003	500,3	76,2	465,5	375	1717,1
▶	#2004	419,5	58,9	327,7	394,6	1987,4
	#2005	448,3	80,5	422,9	282,8	1368,2
	#2006	412	73	327	263	893
	#2007	500	132	513	325	1075

Fig. 1. Access to the hierarchically structured Greek fishery Time series Database

FTS database is a hierarchically structured multidimensional database. It consists of a collection of five data cubes. Onkov (2011); Tegos and Onkov (2015). Three of them concern quantity of catch by fish group and fish species, areas, kind of fishery, and fishing tools. FTS database operates with two types of tables: dimension and fact tables. Dimension tables store attributes values and relationships among tables. Fact tables contain time series data and foreign keys which refer to primary keys in the dimension tables. There is only one entry-point to each fact table of FTS database cubes. Onkov and Stoyanova (2013). The whole data set has temporal character. Data pertinent to catch quantity by areas is spatially oriented. FTS database facilitates flexible: data access, visualization, update and process.

"Quantity of catch" (in metric tons) is accounted by 18 fishing areas and each area by 71 fish species. Figure 1 presents the access to time series on catch quantity of five species in the group Cephalopods. Hierarchical data structure is obvious.

The framework (figure 2) presents the process of studying time series on quantity of Cephalopods catches. The basic operations in FTS database refer to access and extraction of: a) temporal data (time series) on quantity of Cephalopods catches by species; b) spatial time series on quantity of Cephalopods catches by areas. Consequently the computing procedures are used for applying descriptive statistics, graphical presentation of trends and extraction of information for missing catches. The results of time series processing offer the opportunity to estimate sustainability and make comparative and risk analysis of Cephalopods catches in Greece.

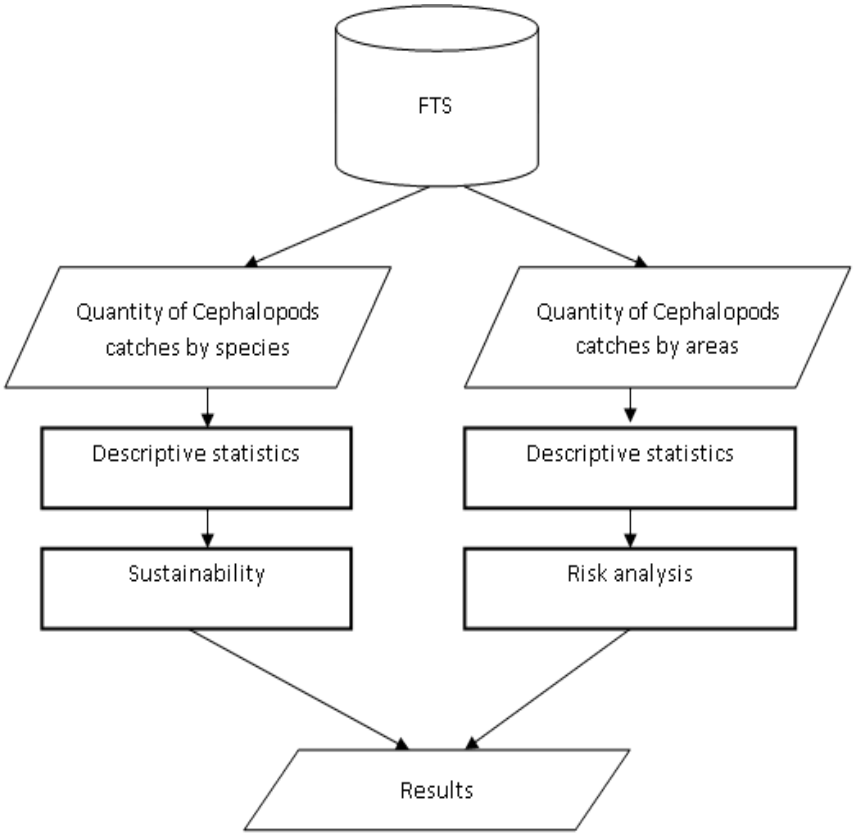

Fig. 2. Framework for studying time series on quantity of Cephalopods catches

3 Results and Discussion

According to Standard Deviation (StDev) and Coefficient of Variance (CoefVar) of descriptive statistics (Table1), it can be derived that the most unsustainable catches are those of Cuttlefish (StDev=872,6, CoefVar=40,2), while the most sustainable ones are those of Flying-squid (StDev=146,2, CoefVar=14,2). Octopus has the biggest average catch quantity - 2346,8 m^3 tons. The coefficient of variation of catch quantity for Octopus (20.2%) is much closed to the coefficient of variation for total Cephalopods catches (19,2%).

Figure 3 shows that the rapid increase of catch quantity in years 2002 and 2003 causes the unsustainability of Cuttlefish that after year 2004 is considered relatively sustainable, especially for the last 4 years (2008, 2009, 2020 and 2011) where the catch quantity is close to 1400 m^3 tons.

The general trend for Cephalopods catches seems also to be sustainable for the last 4 years after the strong decline of 2003-2008 period.

Table 1. Descriptive statistics, catches by species

Code	Cephalopods	Sum	Average	StDev	CoefVar /%/
65	Flying squid	12354,2	1029,5	146,2	14,2
66	Common squid	7782,3	648,5	222,3	34,3
67	Poulp	8785,8	732,2	165,4	22,6
68	Cuttle fish	26042,9	2170,2	872,6	40,2
69	Octopus	28161,8	2346,8	473,7	20,2
	Total	83127,0	6927,3	1326,9	19,2

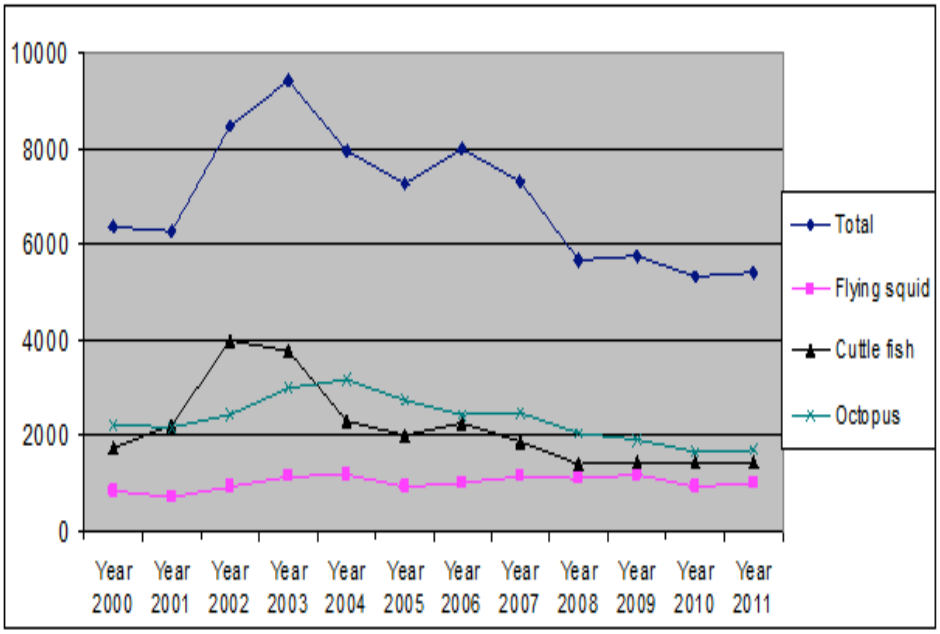

Fig. 3. Quantity of cephalopods catches in Greece

It is possible to view some interesting facts concerning catches by areas and species for the studied time period (table 2). The catches of 0,3 m^3 tons for Poulp and 13,6 m^3 tons for Flying squid in the Gulf of Lakonia area are very low. The lowermost values for total catches of Cephalopods are registered in Gulf of Kyparissia and Gulf of Messinia (151,5 m^3 tones) as well as in Gulf of Lakonia

(118,4 m^3 tones). Economically the most important Cephalopods species Octopus has the maximum value 13009,5 m3 tones in Str. G.,G.of Kavala-Thassos and Sea of Thraki.

Table 2. Total catch quantities by areas and by species for the period 2000-2011

Area name	Flying squid	Common squid	Poulp	Cuttle fish	Octopus	Total
Coasts of Ipiros and Kerkyra	58,3	275,0	157,1	195,3	164,1	**849,7**
Amvrakikos Gulf and coasts of Lefkada island	27,3	283,3	29,8	80,3	84,8	**505,5**
Coasts of Kefalonia, Zakynhos and Gulf of Patra	952,4	1185,1	758,4	965,6	832,5	**4694,0**
Gulf of Kyparissia and Gulf of Messinia	17,6	58,5	7,3	41,1	27,0	**151,5**
Gulf of Lakonia	13,6	42,5	0,3	41,3	20,8	**118,4**
Gulf of Argolida and Saronikos Gulf	919,1	548,9	316,8	335,8	693,2	**2813,9**
Gulf of Korinthia	186,7	100,6	85,0	61,2	70,7	**504,3**
Gulf of S and N. Evia-Gulf of Lamia	924,1	631,9	514,6	698,4	70,7	**2839,7**
Pagassitikos Gulf	109,9	42,2	10,7	65,2	167,3	**395,4**
Eastem coasts of Evia and Sporades islands	497,5	116,8	140,9	103,7	177,7	**1036,6**
Thermaikos Gulf and Gulf of Chalkidiki	2261,4	721,1	1328,5	12770,5	6730,7	**23812,3**
Str. G.,G.of Kavala-Thassos and Sea of Thraki	4757,5	1131,1	4168,9	3825,4	13009,5	**26892,4**
Islands of Lesvos, Chios Samos and Ikaria	516,2	275,9	218,4	716,5	391,7	**2118,7**
Dodekanissos	54,4	194,2	46,0	73,6	590,6	**958,7**
Kyklades	730,2	924,9	663,6	690,1	602,7	**3611,5**
Kriti	315,6	350,8	337,8	625,9	195,2	**1825,4**

Regarding “Number of years without catches” for Cephalopods (Table3) results can be analyzed from both Economical and Biological perspectives. Economical view may concern Skippers, fishermen, local and national wealth etc. and on the other hand Biological view that can be related to Ecological one as well, may refer to lack of sustainability, risk of depletion and risk of extinction of fish species. The

results concerning areas shows that Areas of "Gulf of Kyparissia and Gulf of Messinia" and "Gulf of Lakonia" include the highest risk of all areas since the percentage of years without catches is 38,36 and 23,29, respectively. Especially for Flying Squid and Cuttlefish, in the first area, the percentage is much bigger since in 8 out of 12 years catches are missing while for species Poulp in the second area there are catches for only two years.

Table 3. Number of years without catches

	Cephalopods						
Area name	Flying squid	Common squid	Poulp	Cuttle fish	Octopus	Total	%
Coasts of Ipiros and Kerkyra	3	0	0	0	0	**3**	4,11
Amvrakikos Gulf and coasts of Lefkada island	2	0	0	2	1	**5**	6,85
Coasts of Kefalonia, Zakynhos and Gulf of Patra	0	0	0	0	0	**0**	0
Gulf of Kyparissia and Gulf of Messinia	8	4	8	4	4	**28**	38,36
Gulf of Lakonia	3	0	10	0	4	**17**	23,29
Gulf of Argolida and Saronikos Gulf	0	0	0	0	0	**0**	0
Gulf of Korinthia	0	1	2	3	3	**9**	12,33
Gulf of S and N. Evia-Gulf of Lamia	0	0	0	0	0	**0**	0
Pagassitikos Gulf	0	2	5	1	0	**8**	10,96
Eastem coasts of Evia and Sporades islands	0	0	0	0	0	**0**	0
Thermaikos Gulf and Gulf of Chalkidiki	0	0	0	0	0	**0**	0
Str. G.,G.of Kavala-Thassos and Sea of Thraki	0	0	0	0	0	**0**	0
Islands of Lesvos, Chios Samos and Ikaria	0	0	0	0	0	**0**	0
Dodekanissos	0	0	2	1	0	**3**	4,11
Kyklades	0	0	0	0	0	**0**	0
Kriti	0	0	0	0	0	**0**	0
Total	**16**	**7**	**27**	**11**	**12**		
%	21,92	9,59	36,99	15,07	16,44		

Pertinent to Totals (Sum) in Table1 the most important species of Cephalopods, economically, are Cuttlefish (26042,9 metric tons) which is widespread in almost all fishing areas (Table3) even though it lacks of sustainability and Octopus (28161,8 metric tons) that is relatively sustainable and widespread as well.

Comparing Aegean see areas to Ionian see ones, according to Table 3, it is obvious that the 1st one is more sustainable as it concerns biodiversity.

4 Conclusion

This type of research gives the opportunity to study changes of catch quantities by species and by areas in time. It may constitute an essential tool to support decision making on sea fishery resources and related economical activities.

Scientists as marine biologists, ecologists, economists etc. have to take into consideration such studies and advise people in charge of governments and local authorities to take measures for sustainable fishery as well as social measures for supporting people that will probably be out of work for a certain period of time, in accordance with their suggestions.

If all these parties work in co-operation, the sea fishery sector will be sustainable and continue to provide the nutritious sea fish to the people, jobs to fishermen and support to local and national economies.

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Innovation and Multi Functionality of Female Agriculture in the Short Food Supply Chain. Four Campania Region Case Studies

Marika Zirham[1], Roberto Palomba[2]

[1]Grant holder in Agrarian Economy, Project New Ortho Chain, Italy,
e-mail: marikazirham@gmail.com
[2]Grant Holder in Agrarian Economy, Project New Ortho Chain, Italy

Abstract. This article aims at analyzing the features and the dynamics of female agriculture entrepreneurship in terms of Sustainability Empowerment, in the field of the short food supply chain of fruit and vegetables products. Drawing on the data of the last Agriculture Census (2010) in the specific territorial context of Campania Region, the article analyses the impacts of female management in terms of innovation and multi functionality. In particular, it focuses on experience of direct sale Campania farms in which women's role is crucial: using a survey in the form of open questionnaire, the article tries to answer to the following questions: does it exist a positive correlation between a farm managed by a woman and her innovative incentive in it? Can women concretely promote the innovation and multi functionality of farms in Campania Region?

Keywords: Short food supply chain, agriculture, multi functionality, innovation, well-being sustainability, female entrepreneurship

1 Introduction

This article has the dual aim of contributing to the analysis of female agriculture entrepreneurship in the specific field of the short food supply chain of fruit and vegetables products, and of showing the impacts of female management in terms of innovation and multi functionality. The territory of reference is Campania Region and the perspective is the Sustainability Empowerment, that is the capacity to found the society on the right to sustainability, in which well-being and sustainability are the key strategic objectives[1]. The phenomenon of female agriculture entrepreneurship is not well known yet: in fact, there is a still lacking scientific literature about farms managed by women and their conditions of life and work: since this lack has influenced the effectiveness of interventions in their favour, this phenomenon has to

[1] Simone Cesaretti Foundation, URL www.fondazionesimonecesaretti.it .

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be more studied and analyzed. Until now, it has not been possible to define the importance of the female agriculture entrepreneurship in rural areas, because of structural matters: the available census data, even if produce important socio-economic information, are likely to underestimate or overestimate the extent of the phenomenon: for example, it is not possible to indicate more than one person as a conductor or manager of the farm, and this makes difficult to highlight the cases in which the decision making role is actually played by women (Zumpano 2013)[2].

This work is articulated in three sections. In the first section, we analyse the bond between agriculture and social sustainability, which has led to the development of the short food supply chain as a new opportunity for the marketing of farm products. The second section analyses the features of women's role in the short food supply chain, as a social innovation, and the third section introduces four case studies of farms managed by women in Campania Region. Concluding remarks follow.

2 Agriculture and Social Sustainability

The crisis of the previous agricultural and economic development model made necessary to reformulate the pattern of social economic priorities (ReteLeader 2007)[3] and to create some alternatives to this system (Commissione Internazionale per Futuro dell'Alimentazione e dell'Agricoltura 2003)[4]. This has led to a more and more strong link between agriculture and sustainability: our first aim is the analysis of this link, by keeping the multidisciplinary approach to the analysis of well-being sustainability in relation with the "food sector" theme (Cesaretti 2014)[5]. In fact, in recent years the anthropocentric approach to the environment has been replaced by the ethical one, more focused on the importance of the territory, the quality of products and the careful consumption, according to the Bruntland Report's Sustainable Development definition of 1987: *"man has increased his awareness about his ability to control and manage the needs of the present, without compromising the ability of future generations to meet their own needs, and respecting the environment in its complexity"*. This has led to a reflection about the need to change the forms of production and consumption phases of the agricultural products, by shortening physical and economic but also social and cultural distances

[2] Zumpano, C. (2013), La dimensione femminile dell'impiego agricolo italiano: percorsi differenziati, in *Il capitale umano in agricoltura. Supplemento Agrisole*, 17 May 2013.

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between consumers and producers (Brunori et al. 2012)[6]. In this context, we can find the experience of the short food supply chain, which was born as a reaction to the crisis of intensive agricultural models. Its success derives, on the demand side, from the growing distrust of consumers, out for fresh, safe and high quality products; on the supply side, from the will to reduce competition by focusing on the uniqueness of the products of the territory of reference and the desire to establish a trust-based relation with clients (Ascione et al. 2014)[7]. Therefore, the short food supply chain, creating a direct relationship between producer and consumer (Belliggiano and De Rubertis 2012)[8], is one of the rural development and agriculture multi-functionality components and thus, by encouraging the economic growth in the reference area through social connections at local level, it could be actually considered as a social innovation (Brunori 2007)[9].

3 Women's Role in the Short Food Supply Chain

The special focus on certain items, such as food issues, the reconciliation between production and natural processes and the humanization of the logics of profit see the woman as a privileged interlocutor. At this regard, we can observe that female management sensitivity in food issues can contribute to the food quality and represent a guarantee for the consumer: in fact, women have a greater interest on the environment, biodiversity, food quality, thanks to an innate sensitivity that makes them more suitable for modernizing the production system. Moreover, they are more devoted to all multifunctional activities: the multi-functionality is the main female element especially in the less competitive agriculture: so, this may be a relevant factor not only to revitalize these business types, but also to offer new opportunities to female management. In fact, women have a propensity for innovation and they succeed to quickly adapt they offer according to the changes and to the market and territory demand (Guidi 2009)[10]. Recent studies have shown that Campania agriculture is characterized by an ever greater presence of women both in direction

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and management of farms (INEA 2013)[11]. The results of the last Campania Agriculture Census (2010) showed that over than 37% of farms are managed by women (more than 7% compared with national data) and the rising sector is the fruit and vegetables one, because one-tenth of Italian female farms in this sector is from Campania[12].

The purpose of the research will be to understand if and how women's role could be decisive also for innovation of the Campania short food supply chain, producing some best practices that can allow the female entrepreneurship to pursue its own competitiveness and to contribute at the same time to the global well being sustainability, even as a potential occupational tool.

4 Method

Considering the complex and highly dynamic reality of collective forms of direct sales, the methodology adopted for this research was aimed to capture qualitative features, in order to better understand the specific characters of these realities. The research focused on some Campania direct sale experiences realizing the short food supply chain, in which women play the main role. Since the time to conduct the survey has been short, we have chosen only four case studies, analyzed through the open and semi-structured interview, in order to identify the elements confirming the positive correlation between female farm management and its tendency to innovation and multi functionality, driving the agriculture system towards the environmental, social and economic sustainability. The four case studies on which we have chosen to focus are: the agritourist cooperative *La Ginestra*; the natural farm *Madrenatura*; the agritourist farm *Le Tore* and the natural farm *La Masseria della Contessa*. The direct interviews, even if very informal, have been realized with a semi-structured questionnaire, based on a checklist of essential topics for the analysis. This allowed anyway a wide freedom of interaction, letting the interviewees talking freely about the proposed topics. All interviews were recorded, to allow a further deep analysis of the several aspects identified and investigated.

The interview is structured into two parts: the first describes farm's structural characteristics (such as the birth year, the legal status, the type of management, the right of ownership, the kind of production chain and of short food supply chain and the others activities connected to the main one); the second part describes farm manager's aspects, (in terms both of age, educational qualification and level of ICT, and of values that women try to spread to marketed products and to the activities realized).

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5 Results and Discussion

5.1 La Ginestra[13]

The Agritourist Cooperative *La Ginestra* is situated in Santa Maria del Castello, in the splendid setting of the Sorrento cost, on the Gulf of Naples. The farm, which covers an area of about 8 hectares, cultivated mainly at fruit and vegetables production, was founded in 1997 as a partnership between 7 women: we have interviewed one of these, Carmen Ciampa, 33 years old, with a Bachelor's Degree in Languages. Carmen clearly says that the choice of not leaving the family farm which she helped to create and innovate herself, goes beyond an utilitarian purpose, since it lies in the strong emotional bond with her farm, despite many economic, bureaucratic and even cultural difficulties incurred. Over twenty years of activity, this link has strengthened, together with the will to escape from the traditional patterns of food production and consumption, towards the promotion of a healthy nutrition and a sustainable environment. That is why *La Ginestra* produces sustainability and generates income in the territory, through several innovative types of products sale: first, it is mainly used the direct selling in the farm, for example of the honey, the farm's flagship, or other products harvested directly from the partners' parents. Then it is practiced the so-called 'pick you own' method, which allows the clients to choose and directly grasp the desired products, and even to personally cook them, giving an added value to the product marketed. Another innovative type of direct sale is the so-called 'box schemes' method: twice weekly some boxes, consisting of a certain prearranged amount of fruit and vegetables in season, are delivered in Naples, in a predetermined point of collection. The composition of the box varies from week to week depending on products availability and thus it is very flexible, because it can be planned by telephone[14]. The farm innovative and multifunctional drive is evident also regarding to the other connected activities that the farm realizes: not only the agritourist and restaurant services, but also the educational farm, that can be a communication tool with children and families, spreading the importance of agriculture and the knowledge of the land of reference. Carmen is teacher at a local school, and succeeds to combine its two business activities, proposing to her students some educational guided tours at her farm, with the aim of allowing young people to rediscover the bond between man and nature, and to make know her job. Another related activity is the realization of guided tours around the farm: in fact, having signed a contract with a Dutch agency, the farm hosts many foreigners loving trekking and hiking through the several routes along the Lattari Mountains.

[13] The case studies *La Ginestra* and *Madrenatura* have been realized for the research conducted together with Roberto Palomba ("Female agriculture in the short food supply chain. A new path toward the Sustainability Empowerment"), presented at Florence SWIF – "Sustainable of well-being International Forum, Food for sustainability and not just food", set in Florence from 4th to 6th June 2015.

[14] The several activities realized, such as the educational farm or guided tours are also available online: *La Ginestra*'s website is http://www.laginestra.org/

5.2 Madrenatura[15]

The natural farm *Madrenatura*, covering an area of 1.5 hectares in Poggiomarino, between Naples and the Sarno river valley, an area as fertile as attacked, was founded in 2009 by Marialuisa Squitieri, 36 years old, with a Bachelor's degree in Medieval History. She describes herself as a 'resistant farmer', because its organic agriculture endures intensive mass productions, prefers quality over quantity, and does not use GMOs or chemicals. In fact, she cultivates natural and untreated products, through a biological not certificated method to preserve the typical products. Indeed, *Madrenatura* was born from the intent to directly propose local products to consumers, without intermediaries, and from the desire to get away from the devalued logics of the market, in which the intermediaries speculate on the farmers work. The key element to achieve this goal is exactly the short food supply chain, that is realized with direct sales, which *Madrenatura* practices through *box schemes*, whose beneficiaries are mainly SPGs (solidarity purchasing groups) and families, and through the participation in the '*farmer's market*', ideal place for the meeting of aware consumers whose lifestyle is the research for food quality. From the need to create a fixed meeting point in the city with consumers was born the project "*The Garden in the City*", a store in the heart of Naples, which is not a simple fruit and vegetable shop, but it is a solidarity place aimed to save the typical cultivations of the Vesuvius and Sarno area. Her mission is to help to increase consumers' awareness about the need to change their purchasing and food consumption patterns, by favoring the periodicity[16]. Women's main characteristic, that we have found here, is the ability to be multitasking in the farm: in fact, besides taking care of bureaucracy and fiscal management, Marialuisa organizes sowings and harvests, controlling fields organization, manages the shop and arranges orders and sales, also following the orders of the buying groups. Moreover, an added value of the farm emerged from the interview is the strong network of relationships that Marialuisa has managed to create over time, not only with customers but also with small local producers by helping them in the sale of their products. This proves the virtuous circle that, basing on the principles of fairness, ethics and sustainability, favors farms, particularly female ones, that are most suitable to establish and enhance the development of these networks, not only economically convenient but also made of satisfying human relations.

[15] See note above.

[16] It is possible to buy products also through *Madrenatura*'s website: http://www.madrenaturabio.it

5.3 Le Tore

The agritourist farm *Le Tore* is located in Massa Lubrense, in the heart of the Sorrento peninsula, between the Gulfs of Naples and Positano. The farm, which covers an area of about 14 hectares, was founded in the early 80s by the parents of the current owner: Vittoria Brancaccio, 57 years old, with a Bachelor's Degree in Agronomy, that has been working in the farm since she was little. The interview immediately shows the female innovative mark: in fact, even if in the early years of activity there were not yet the protected designation of origin in that area and the national law on the agritourism, Vittoria in 1982 already had applied to make an agritourist farm and it is thanks to her pressure on municipal administration that Massa Lubrense has become "oil city"; moreover, Le Tore is the first Campania farm to join in 1994 the system of organic certification. One of the feature of the farm is the diversified products sale: first, the direct sale, both in the farm for the agritourism clients, and in an external store in Naples; then, the sale by subscription, through the shipment in the world of high quality products. The farm, therefore, is well renown at national and international level, thanks mainly to the production and sale of oil, its flagship, and for the chance to go trekking: for this, *Le Tore* is often quoted in several international magazines, such as *The Guardian* and *The Washington Post*, and in many foreign travel guides, such as *Lonely Planet*, *Guide Routard*, *GO*, and in the important Dutch magazine *Seasons*[17]. The farm also realizes the "educational farms" for all types of users interested in visiting the farm, tasting and sensory analysis of oil and wine: this activity enhances the products sale. The interview highlights two elements: the multi functionality of a farm managed by a woman, more versatile and adaptable: *"(...) this is why women can make a little bit of everything, for their ability to be multi-tasking and multi-functional"*. In fact, Vittoria, which coordinated for six years the agritourist sector of the Confederation of Italian farmers, manages the farm - both the agricultural features and bureaucratic and fiscal ones - she is in charge of food service, she chooses the kind of production, and she organises the staff. The second element is the strong female tendency to innovation and modernity: women, which are able to learn more easily and more quickly, also thanks to the curiosity showing in any activities that they carry on: *"(...) beyond the generalisations, I can say that women are a step ahead on men. On average, the skills being equal, the capable man consider himself unchangeable, while the capable woman proves to be more curious and innovative, and she always is ready to the change and improvement"*.

5.4 Masseria La Contessa

The natural farm *La Masseria della Contessa*, covering an area of over 3 hectares, is located in the Caudina Valley, in the heart of Campania plain and was founded in 2012 by Giulia Antonuccio, 30 years old with a Bachelor's Degree in Agronom, which manages it with her husband. Giulia represents the real woman entrepreneur:

[17] *Le Tore*'s website, available in Italian, English, French and German, is http://www.agriturismosorrentoletore.com

her idea to cultivate beans from South America - which she analyzed during university and post-graduate research - was due to the fact that the cultivation of these legumes, by providing nitrogen to the soil, is “healthy and not exploitative”. This confirms the female vocation towards agriculture closer to food security and the environment-friendly, because the South American beans variety can create biodiversity in this specific farming. Therefore, the *Masseria* innovates in the field of legumes cultivation, testing, for the first time in Italy, the so called “heirloom bean”, which well reacted to the challenge, adapting to climatic agronomic conditions. This allowed to cease importing seeds from South America, and to invest in direct cultivation, by continuing to innovate, also experimenting some intersections in different species of beans, thus creating new varieties[18]. Another unique element of the Masseria’s product is the packaging: in fact, Giulia chose quadrangular glass jars, with a basic label, because a product well packaged gives an idea of not commercial and recalls the fact that it is carefully by traditional methods hand-cultivated, trying to combine tradition and innovation; moreover, this choice confirm the tendency towards sustainability, because the jar is reusable. Beside the innovation feature, this case study also shows the multifunctional aspect of farms managed by women: Giulia works almost alone in the farm, helped only by her husband, a photographer who has chosen to follow his wife’s passion and innovative ideas. An important female characteristic, that Giulia recognizes to herself, and that the interview has confirmed, in addition to the multi-functionality, is the strong tendency to be fanciful, that fosters innovation in agricultural production: *“Women often have insights that men have not, because they tend to throw themselves headlong into work, without that typically female stroke of genius, which turns into a more innovative work*". Thus, to be a woman entrepreneur means to have more and better ideas, that can create interest among consumers: in fact, women are likely to be more empathic with both clients and producers; for example, the Masseria organizes the annual event of the sowing of beans: Giulia invites friends and acquaintances who, while having fun in a convivial atmosphere, are planting together for three days, even sharing lunch and dinner, bringing thus farming to its original function, the sociability.

6 Concluding Remarks

The recognition of the multifunctional role of agricultural activity has led to the overcoming of its only productive dimension and to the promotion of its ability to produce services for the community, realizing activities related to the territory and the environment. In fact, agriculture performs nowadays various and diversified functions: economic, environmental, social, cultural, educational, recreational. In this context, the agricultural policy is becoming also a land policy, because the agricultural sector can promote the economic and social development of a country

[18] It is possible to discover and buy the different varieties of legumes on the Masseria’s website http://www.masseriadellacontessa.com and at facebook page https://www.facebook.com/lamasseriadellacontessa?fref=ts .

more and more interested to environmental issues and to the research of healthy and high quality products (Sanlorenzo 2011)[19]. Particularly, the agriculture food sector has a strong multi functional character: in some areas, it maintains its productive and commercial character, but in other ones it takes on a complementary role, for the generation of income and the economy of the territory, also having a social value connected to the enhancement of the cultural and landscape characteristics of the area in which it is conducted. An important contribution to the multi-functionality of agriculture is certainly provided by the work of women (Unioncamere 2010)[20]: in fact, they tend to orientate farms to diversification, particularly with the agritourism, food processing and provision of certain services to the population such as recreational activities, educational farms, disabled hospitality and assistance, etc (NoiDonne 2013)[21]. This research has therefore confirmed that female entrepreneurship tends to be innovative and multi-functional, increasing the productive offer and having positive effects also on generational change and the permanence of young people in rural areas (Sabbatini 2006)[22]. Here, women could support the local economy through strategic alternative pathways, improving living conditions of rural and agricultural contexts (Guidi 2008)[23]. In particular, in the short food supply chain, the female contribution is particularly important, since women are more able to integrate the community and build social ties, sense of trust and reciprocity:(Giaré and Giuca 2012)[24]. Thus, the typical female features, such as the high care and precision in carrying out the duties, the kind and polite behaviour in relating not only with the customers, but with all the stakeholders of the farm, can promote the implementation of direct sale of agricultural products (Giampaolo 2006)[25]. Thus, the final consideration is that we still need a greater attention on the part of European policy makers to these issues, to facilitate the female agriculture entrepreneurship, as well as the rural development and environmental protection (Andreopoulou et al. 2014)[26]. Moreover, it is necessary to reduce conflicts between the different roles played by woman as entrepreneur, wife, mother and housewife, helping her to reconcile the different functions with adequate services even in rural

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areas (health, education, transport), by realizing effective mainstreaming policies. The enhancement of the role of women is very important both in a microeconomic perspective, linked to the structure and performance in time of farms, and in a macroeconomic approach, in reference to the rural dimension and to the complex of agricultural activities, in order to ensure the principle of Equal Opportunities between men and women, which is one of the EU fundamental rights.

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Moreover, this research has completed and mainly analyzed – with additional case studies - the results described in the research conducted by Marika Zirham and Roberto Palomba "Female agriculture in the short food supply chain. A new path toward the Sustainability Empowerment" (in press), presented at Florence SWIF - Sustainable of well-being International Forum, *Food for sustainability and not just food*, set in Florence from 4th to 6th June 2015.

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Session 7: Marketing & Entrepreneurship

The Corporate Social Responsibility in the Greek Agri-food Sector

Anastasios Liapakis[1], Constantina Costopoulou[2], Alexander Sideridis[3]

[1]Department of Agricultural Economics and Rural Development, Agricultural University of Athens, Greece, e-mail: liapakisanastasios@aua.gr
[2]Department of Agricultural Economics and Rural Development, Agricultural University of Athens, Greece, e-mail: tina@aua.gr
[3]Department of Agricultural Economics and Rural Development, Agricultural University of Athens, Greece, e-mail: as@aua.gr

Abstract. The Corporate Social Responsibility has become an essential factor involved in the process of customers choosing products or services. It focuses on the common place notion of "think global, act local". While Corporate Social Responsibility research has been conducted in many industries, the food sector has been largely ignored. Especially, the agri-food sector has a strong impact on the economy, the environment and the society and in the past it has been plagued by many scandals of environmental degradation. In this context, the purpose of this paper is to analyze the largest fifty six Greek food companies in dairy and meat industries about their Corporate Social Responsibilities. The analysis provides an overview of the current status of the Corporate Social Responsibility practices of the leading companies in the aforementioned industries as well as insights in future trends in this unfolding national financial-debt crisis.

Keywords: Corporate Social Responsibility, Food industry, Diary industry, Meat industry

1 Introduction

Researchers and academics perceive Corporate Social Responsibility (CSR) as a company's involvement in activities with social applications. The notion of CSR has evolved over the last six decades going through multiple conceptualizations. Numerous researchers have contributed to the development and definition of the concept of CSR and each decade brought with it new definitions and improvements to this notion. Nowadays, more and more academics and researchers consider that the study of CSR is an urgent need. But what is CSR and how many companies use this strategy?

There is no a common definition of CSR in literature. This is due to the multidimensionality of the CSR concept depending on the regional-cultural, socio-cultural or sectoral characteristics of each country (Skouloudis et al., 2014). Broadly

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defined CSR is a group of actions developed by some companies in order to cope with core problems of society and environment in general. Kilkenny et al. (1999) state that CSR, is "a company's commitment to the well-being of its workers and their families, as well as to the community and environment in which it operates, and the actions that follow from that commitment". According to ISO 26000 (ISO, 2010) CSR is defined as: "the responsibility of an organization for the impacts of its decisions and activities on society and the environment, through transparent and ethical behavior that contributes to sustainable development, including health and welfare of society, takes into account the expectations of stakeholders, is in compliance with applicable law and consistent with international norms of behavior and is integrated throughout and practiced in an organization's relationships."

If a company would like to be corporate responsible should be corporate financial responsible, corporate social responsible and corporate environmental responsible. This means that, CSR incorporates the economic, social and environmental strands of sustainable development and provides a holistic approach for companies to understand the issues in sustainable development.

The purpose of this paper is to examine the CSR practices adopted in the Greek agri-food industry, especially in dairy and meat industries. In this context, a sample of the fifty six largest companies operating in Greece has been used. The website of each company related to CSR has been investigated. The structure of the paper is as follows: Section 2 discusses the involvement of consumers to CSR. Section 3 gives a brief overview of CSR in Greece. Section 4 presents the analysis results of CSR in the Greek agri-food sector, especially in dairy and meat industries. The analysis is referred to the evaluation of companies' websites according to a number of criteria such as the adoption of social, environmental and/or cultural practices. It has taken place from February till April 2015. In the final section, some conclusions are given.

2 The Involvement of Consumers to CSR

After the 1990s, several researchers have started investigating the effects of CSR on consumers and found that consumers expect a high degree of corporate responsibility (Mohr et al., 2001). Several studies showed that CSR has a positive effect on consumers' attitudes and purchase intention and that negative CSR degrades consumer outcomes (Brown and Dacin, 1997; Mohr and Webb 2005; Murray and Vogel, 1997; Barrett, 1996). In addition, different researchers have investigated the effects of CSR on willingness to pay and found that consumers accepted higher price levels for products from ethical companies (Auger et al., 2003). In Greece, consumers are willing to pay more for a product which adopts a CSR campaign especially in social domain (Liapakis, 2013).

During the last decade, new results further clarified the factors that affect consumers' responses in a CSR setting. Webb and Mohr (1998) looked at the effects of CRM on consumer attitudes and attributions and generated a classification based on their responses. Mohr et al. (2001) extended their previous study using a generic CSR case and classified consumers based on their purchase intention. A different study showed that in a CSR context, consumers make self and other-driven

attribution, a view which has been further developed by subsequent researchers. One of the landmark studies was carried out by Ellen et al. (2006). The main thesis of their work was that consumers' attributions are key psychological mechanisms that influence consumers' reactions in a CSR context.

The most important properties of a CSR strategy are the CSR timing, the CSR investment, and the CSR information source. The CSR timing property, explains companies choice to deploy CSR initiatives either voluntarily (proactively) or as a response to some negative event (reactively) (Ricks, 2005). The CSR investment is defined as the amount of financial resources and time which used in a CSR campaign.

3 CSR in Greece

In Greece, CSR is considered to be in its infancy. The difficult period which faces Greece, due to the economic crisis, makes companies face major problems such as unemployment, poverty, immigration etc. A lot of companies try to adopt CSR campaigns in order to achieve their goals as social entities but several barriers like, the bureaucracy, the lack of financial and tax motives make it difficult for them to emerge fastest.

Nevertheless a number of leading Greek firms try to pioneer despite the barriers faced. A promising example is the Hellenic Network for CSR. The Hellenic Network for CSR is a non-profit organization having as members 138 companies and 7 business associations. It is run by a seven member Board. Main objectives of the Network are to promote the CSR concept and principles and disseminate them to the Greek business society and to society as a whole with the overall objective being a balance between profitability and sustainable development (www.csrhellas.gr).

In Greece, the number of companies operating is about 800,000. As we can see in Table 1, only 810 out of 800,000 companies (0.1%) use CSR. Out of these 810 companies, only 28 are issuing CSR reports and the frequent method of this reporting is the self annual reports. The core CSR activities of these companies are in telecommunications, in food industry, in logistics and in the sailing businesses (Liapakis, 2013& Liapakis, 2015).

Table 1. The CSR data in Greece.

Parameters	Numbers
Number of companies which use CSR in Greece	**810**
Number of organizations issuing CSR reports	**28**
Number of companies in Greece	**Up to 800,000**
Frequent method of CSR reporting	**Self annual reports 25/28**

Furthermore, Skouloudis et al. (2014) state that Greek companies tend to pay more attention on non-financial aspects of business operation emphasizing in the adoption of environment management systems, waste management practices and employee training and health measures along with possession responsibility procedures.

4 CSR in the Greek Agri-Food Industry

While a lot has been written and researched about sustainability in food production and processing, very few papers investigate CSR activities in the food sector. This sector is especially prone to problems in sustainability given its high impact and dependence on natural, human and physical resources (Genier, et. al, 2009). The sustainability challenges faced by the food sector are numerous, including environmental sustainability (usage of natural resources, animal welfare, etc.), social sustainability (labor and work conditions, food safety, etc.), and economic sustainability (energy usage, waste management, etc.). All food products carry credence and experience attributes and forging a reputation of good citizenship will most likely improve consumers' reactions to brands. These products will be assumed to have high added-value product and process attributes (McWilliams and Siegel, 2001, Siegel and Vitaliano, 2006).

In the following, table 2 presents data about three main financial indicators of the 200 biggest companies in Greek food industry, namely (i) sales, (ii) Earnings Before Interest, Taxes, Depreciation, and Amortization (EBITDA), and (iii) gross profit.

Table 2. Financial indicators of the 200 biggest companies in food industry in Greece.

Indicators	*2012 (Thousand €)*	*2013 (Thousand €)*
Sales	43.910	43.044
EBITDA	2.883	2.110
Gross Profit	-1.104	-1.430

In order to understand the application of CSR in the Greek dairy and meat industries, a sample of the fifty six largest companies operating in Greece, based on their annual sales of 2013 as published in their balance sheets, has been studied. The sample includes large companies since are much more activated in CSR actions than the small and medium enterprises in Greece (Skouloudis et al., 2014). The examined companies and particularly, the name of each company and its appropriate URL related to CSR practices can be retrieved from the following URL: https://www.dropbox.com/sh/5bzaubmupoi123d/AADOQcu30jOCqBw5QXh1AEEca?dl=0. Table 3 presents the data of the three aforementioned financial indicators of these companies.

Table 3. Financial indicators for the biggest companies in meet and diary industry in Greece.

	Meat Industry		*Dairy Industry*	
Indicators	*2012 (Thousand €)*	*2013 (Thousand €)*	*2012 (Thousand €)*	*2013 (Thousand €)*
Sales	43.910	43.044	63.417	56.905
EBITDA	2.883	2.110	3.072	2.824
Gross Profit	-1.045	-1.430	-2.516	-2.053

We can see that in both industries, sales have decreased significantly. But what happened in the CSR strategies in these companies? Which are the major applications?

In the following tables, data about the Greek dairy industry and meat industry are presented. Twenty seven leading companies in the dairy industry and twenty nine companies in the meat industry have been examined. The results are presented in Table 4 and Table 5 for the dairy industry and the meat industry, respectively. Table 4 illustrates that, only sixteen out of twenty seven of the biggest companies in dairy industry adopted a CSR campaign (59%). The domains of these CSR campaigns are in social, environment and culture activities. However, the main applications focus on social activities. Twelve out of sixteen companies (75%) adopted social

campaigns when environmental campaigns adopted only eight to sixteen (50%), cultural campaigns only two to sixteen (13%) and only 25% of companies adopt multiple domains campaigns.

Table 4. The CSR data in the Greek diary industry.

Parameters	Data
Number of examined companies	**27**
Number of companies which adopt CSR campaigns	**16**
The percentage of companies which adopt CSR campaigns	**59%**
Main applications of CSR campaigns	**Social, Environment, Culture**
Number of companies which adopt social campaigns	**12/16**
Number of companies which adopt environmental campaigns	**08/16**
Number of companies which adopt cultural campaigns	**02/16**
Number of companies which adopt multiple campaigns	**04/16**

From 29 leading companies in the meat industry 14 of them have adopted CSR campaigns (48%) as shown in Table 5. The fields of the main applications of these CSR campaigns are in social, environment and culture activities. Although, the Food and Agriculture Organization of the United Nations (FAO) reported in 2006 that agriculture and food processing, in general, pollute the environment in significant ways (reduction of biodiversity, water usage and contamination, greenhouse gases emission, etc.), the main application are in social activities. Eleven out of twenty nine companies adopted social campaigns when environmental campaigns adopted only eight. Twelve out of fourteen companies have adopted social campaigns (86%); eight companies of them have adopted environmental campaigns (57%) and only three companies of them have adopted cultural campaigns (21%). 50% of the meat industry companies which use CSR campaigns have adopted multiple domains campaigns.

Table 5. The CSR data in the Greek meat industry**.**

Parameters	Data
Number of examined companies	**29**
Number of companies which adopt CSR campaigns	**14**
The percentage of companies which adopt CSR campaigns	**48%**
Main applications of CSR campaigns	**Social, Environment, Culture**
Number of companies which adopt social campaigns	**12/14**
Number of companies which adopt environmental campaigns	**08/14**
Number of companies which adopt cultural campaigns	**03/14**
Number of companies which adopt multiple campaigns	**07/14**

5 Conclusions

Nowadays, there is an increasing number of companies around the world that are involved in CSR activities. In this light, this paper provides a better understanding of the current status of the CSR activities adopted by the leading companies in the Greek agri-food sector. The study is focused on the dairy and meat industries because of CSR's high dependence on natural and human resources. It is based on the evaluation of the website of each company related to CSR practices.

The analysis' results show that firstly, a significant percentage of companies try to help the society in spite of the barriers of the profound debt crisis. Secondly, the Greek agri-food companies have started to pay attention in CSR strategies. Third, CSR in the dairy industry is more dynamic than in the meat industry since sixteen companies out of twenty seven in dairy industry has adopted a CSR campaign (59%) whereas fourteen companies out of twenty nine (48%) in meat industry has adopted a CSR campaign. Also, the majority of the companies have adopted social campaigns in both industries, followed by environmental and cultural campaigns.

As far as limitations of this study are concerned, the small sample size of the examined companies as well as the focus of the study only on CSR quantitative (and not qualitative) characteristics reflect only indicative findings.

Future work will focus on the willingness of online consumers to pay more for agri-food products provided by Greek online companies that are committed to positive social and environmental impact.

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Social Commerce and Marketing Strategy for "Made in Italy" Food Products

Alessandro Scuderi[1], Luisa Sturiale[2]

[1]Department of Agrifood and Environmental Systems and Management (Di3A), University of Catania, Italy, e-mail: alessandro.scuderi@unict.it
[2]Department of Civil Engineering and Architecture (DICAR), University of Catania, Italy, e-mail: luisa.sturiale@dica.unict.it

Abstract. The ICTs have enabled the transformation of processes of production, access, transfer, use and, in recent years, the sharing of information (email, forums, and social networks), reducing the spatio-temporal barriers. However, despite the fact that investments in new technologies have increased in recent decades, Italian agri-food and agricultural enterprises have still not bridged the digital divide. Nevertheless there are interesting potentials for growth, with the advent of Web 2.0 (and the latest web 3.0) and with *social media*. The aim of this study is to provide a brief overview of the developments in the Digital Economy and of the changes that have occurred in business to consumer models. In particular, the state of the art for agri-food products in relation to the evolution from "*e-commerce*" to "*social commerce*" will be analysed, through a specific survey, consisting of two complementary phases, related both to online businesses and to the web consumers.

Keywords: agrifood, e-business, social media, glocal, 8P's social marketing.

1 Introduction

In the ICTs sector, innovations follow each other swiftly,as it is a very dynamic market, where Web 3.0 represents the latest phenomenon, after Web 2.0 that had revolutionised the global world of *information* (Bethon *et al*., 2012;Neison *et al,* 2010) . There has been an evolution of sites and services in the Web, such as wiki sites and social networks, where interaction and sharing of content by users are fundamental. The web has become a "web ecosystem" in which users create value by sharing and creating experiences in the Web (through e-mail, blogs, networking, forums, communities, chat, etc.). The Internet has become the global platform for exchange, the space where an economic force of global dimensions operates, which has radically modified social and economic behaviour ((Brush *et al*., 2010; Kumar *et al*., 2012; Sturiale, 2000; Whang *et al*., 2012)

In the European Union the digital economy is growing seven times faster than the rest of the economy, but its potential is currently hindered by an inconsistent strategic framework across European countries.

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With regard to the Italian food market, specific studies on the Digital Economy refer to surveys on the size of the phenomenon, on "e - commerce" in individual sectors, on web marketing, and on B2B[1]).

The objective of this study is to provide a first contribution to the knowledge of the recent phenomenon of *social commerce* in the Italian agri-food economy, and to the analysis of the *social media marketing* used, following the 8 Ps approach (Dastak *et al.,* 2014), . To this end, a specific research has been carried out, involving two complementary phases, relating to Made in Italy food production companies that are present online, and to web consumers.

2 The Opportunities of the Digital Economy for Agri-food Enterprises

The size of the Digital Economy is particularly relevant given the growing importance of the ICTs as a policy tool. There is a high level of interest in measuring the Internet economy as a way to understand the effects of various investment strategies, regulatory rulings, and policy decisions.

In 2014 the world digital market continued its growth, registering a + 3.6% increase, with a global value of 4,538.6 billion dollars. (Assinform- NetConsulting, 2014). The phenomenon of social media is growing globally: there are 1.75 billion users of social networks.

ICTs are making companies' business ever more efficient: enterprises are looking more and more to technology to reduce costs, creating an ever growing demand for technological services and products.

According to the OECD (2012), the American market is the most important in terms of number of employees, with a share of 30%, followed by Japan (16%) and Germany (9%). According to the Boston Consulting Group, in 2016 the net economy of the G20 countries will reach 4.2 trillion, 3 billion people will be connected to the Internet on various devices. For the G20 countries, an annual rate of growth of 10% is estimated, while that of the emerging markets will almost double (approximately 18%).

The EU is also focusing on ICTs as a strategic lever to relaunch the European economy through the economic advantages and social sustainability that are offered by a unified digital market[2]).

The main elements of the #ContinenteConnesso proposal are open Internet, strengthening the consumer rights, abolition of additional roaming costs in the EU, coordinated spectrum frequency allocation, adding certainty for investors.

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[1] From among the various contributions to be found in the literature, we cite a few: Sturiale L., 2000; Sturiale and Scuderi, 2001; Bucca *et al.,* 2006; Canavari, Pignatti, and Spadoni, 2008, Brush and McIntosh, 2010; Neilson, Madill, and Haines, Jr., 2010).

[2] As reported by the Digital Agenda (2012), in the EU the digital economy is growing by 12% each year; employment in the field of ICTs is approximately 7 million, and it is estimated that this will increase to 16 million by 2020. It is estimated that half of the productivity growth results from investment in this sector.

In spite of the developments that have affected the ICTs and that are reflected in all areas of social and economic life, a digital divide still remains. In the "*Connectivity Scorecard*"[3] ranking, which assesses the impact of the Web on national economies, in 2014 Italy was in 22nd out of 26 countries, which were considered as innovation-driven economies (Denmark, Sweden, and the United States were in the lead, while ranked behind Italy were Greece, Portugal, Hungary, and Poland).

At the same time, a study conducted by Google[4] showed that online searches for Italian products in 2014 increased by 13% compared to 2013; amongst the most clicked categories of the "Made in Italy", the top searches were in the fashion and car sectors, followed by tourism, agri-food, and furniture.

In the Italian agri-food economy, since the 90's many companies have implemented new "*e-business*" and web marketing organisational models, to adapt to the new competitive environment. They have adopted new strategic tools for market knowledge, brand awareness of their product, and customer interaction (from one-to-one marketing, to social networking, to storytelling). The last frontiers are represented by *social commerce*, *Apps*[5], and the developments of the mobile and content marketing, to name just a few.

Despite these developments, in Italy we are far from both the European average and from the goals set by the Digital Agenda. According to recent surveys, in Italy mistrust of online purchase still persists due to the following reasons (in decreasing order of importance): preference for physical contact with products; payment deemed unsafe; high shipping costs; long shipping times.

In 2012, 29% of Italian Internet users bought online, while the European average was 59%. With regard to the types of goods and services purchased, by far the largest part were for tourist services, books, and clothing, while only 1% was dedicated to food products (compared to a European average of 6%). Therefore there would be a lot of room to develop agri-food "*e-commerce*", if that was supported by an adequate web marketing and by utilising the latest web technologies.

[3]The Connectivity Scorecard is the first index to examine quality and quantity of ICT usage and infrastructure, and to link it to a country's social and economic prosperity. The research focuses on 52 countries. These have been divided into two scorecard groupings according to their economy type as defined by the World Economic Forum.

- Resource-driven economies: Resource and efficiency-driven economies are less well developed than the innovation-driven economies;
- Innovation-driven economies: Innovation-driven economies are more highly developed than resource and efficiency-driven economies. (http://www.connectivityscorecard.org).

[4] Analysis by Google has evaluated the behaviour of users from 10 foreign countries, with different characteristics: from the United States to Germany, from the UAE to Brazil.

[5] Start-up technologies are growing rapidly in Europe; the European *App* market generates revenues of €17.5 billion and boasts 1.8 million jobs (Digital Agenda, 2012).

3 *E-commerce* Versus *Social Commerce*

The spread of the Internet, whilst not changing the fundamental rules of the economy, has led to an amplification of the information revolution (Porter, Millar, 1985).

Information Systems are being enriched by tools and areas for interaction that are designed to respond to the emerging needs of businesses and of consumers, thanks to the tools of Web 2.0 and of the latest Web 3.0. Among them, social networks, a worldwide phenomenon that is changing the way of doing *e-business*, assume a very important role, fully considered as a valid support for corporate strategy through an *omni-channel* approach. This provides the synergy of different channels to obtain a widespread and pervasive presence, with the primary objective of listening to the customer and his needs.

Companies are internalising the new market culture and technologies, changing their business models passing through different phases, from "*e-trade*", to "*e-commerce*", then onto "*e-business*"[6] and, the latest frontier of "*social commerce*", following the development of Web 2.0 and the *social network* (Huang, Benyoucef, 2013).

Italian companies should seize the opportunities offered by *social networks*, using them as a primary instrument for relating with the customer (Tab. 1), considering the fact that more than 70% of Italian Internet users (more than 38 million in 2014) are *social network* users[7].

[6] In detail, "*e-trade*" is understood as the electronic channel complementary to the traditional ones, "*e-commerce*" allows the interaction with the market; "*e-business*" uses the integrated technological elements in the internal and external processes of the enterprise to obtain a sustainable competitive advantage (Scott, Murtula, Stecco (eds), 1999).

[7]According to the Facebook Observatory, in 2014 Facebook had 1.39 billion subscribers worldwide, Italy ranked ninth in the world, with 28 million Italians enrolled, of whom 20 million were daily users. The other social media (Google, Twitter, LinkedIn, Tumblr, Pinterest) reached a total of approximately 28 million enrolled users. This is a far-reaching social phenomenon that has led to the opening up of *social advertising* and *social commerce.*

Table 1. Enterprise websites and social media use in the EU 28 (2013) (http://ec.europa.eu/eurostat)

Enterprise websites and social media use, 2013
(% of enterprises)

	Website	Use at least one type of social media	Formal policy for social media use	Social networks	Multimedia content-sharing websites	Blogs or micro blogs	Wiki-based knowledge-sharing tools
EU28	**73**	**30**	**8**	**28**	**11**	**10**	**6**
Belgium	78	35	9	31	16	10	5
Bulgaria	47	31	6	30	9	5	4
Czech Republic	80	16	5	15	6	3	2
Denmark	92	40	16	36	14	8	5
Germany	84	33	7	29	13	7	11
Estonia	76	27	4	24	7	5	2
Ireland	75	48	20	46	14	20	7
Greece	61	34	8	28	16	11	7
Spain	68	31	9	29	15	13	5
France	65	19	4	17	5	5	3
Croatia	68	37	7	30	14	6	13
Italy	67	25	5	21	10	6	4
Cyprus	66	38	17	37	13	13	4
Latvia	56	15	3	13	5	7	2
Lithuania	75	38	6	31	16	9	14
Luxembourg	79	30	6	26	12	8	7
Hungary	61	26	3	22	10	2	6
Malta	78	55	14	52	20	12	11
Netherlands	84	50	18	45	23	27	7
Austria	86	39	11	35	14	7	10
Poland	66	19	3	16	8	3	4
Portugal	59	36	9	33	12	6	4
Romania	42	19	5	17	6	3	2
Slovenia	80	37	9	34	13	8	2
Slovakia	80	26	8	21	11	4	6
Finland	94	37	13	34	14	8	6
Sweden	89	45	15	42	16	13	9
United Kingdom	82	42	15	40	15	23	6
Iceland	83	60	12	58	18	14	5
Norway	79	46	17	43	12	9	5
Former Yug. Rep. of Macedonia	54	36	8	33	15	6	7

Among them, *social commerce* is becoming ever more strategic. This is a new category of e-commerce activated through the use of social media platforms and social network services (Kumar, Rajan, 2011; Marsden, 2010). It was introduced for the first time by Yahoo in November 2005, and has grown rapidly in the past 5 years, giving rise to "*social media marketing*". This involves a convergence between the online and offline environments.

Since social media have become readily accessible, more consumers use it as a source of information about companies, brands, products, and services by social networks and e-WOM (electronic word of mouth) (Sturiale, Scuderi, 2013; Scuderi, Sturiale, 2014; Wang, Zhang, 2012).

Today it is possible, to distinguish different types of social commerce (Indvik, 2015):

1. **Peer-to-peer sales platforms** (eBay, Etsy, Amazon Marketplace).
2. **Social network-driven sales** (Facebook, Pinterest, Twitter).
3. **Group buying** (Groupon, LivingSocial).
4. **Peer recommendations** (Amazon, Yelp, JustBoughtIt).
5. **User-curated shopping** (The Fancy, Lyst, Svpply).
6. **Participatory commerce** (Threadless, Kickstarter, CutOnYourBias).
7. **Social shopping** (Motilo, Fashism, GoTryItOn).

4 Survey Method

In order to analyse the state of the art for agri-food products in relation to the evolution from e-commerce to social commerce, a specific survey was conducted in two complementary phases, relating to businesses and consumers.

The **first phase** provides a brief overview of the relationship between the agri-food economy, ICTs, customers, and marketing. This analysed and assessed the leading agri-food SMEs present on the Internet to understand, firstly, what the strategic goals of the business are and, secondly, to evaluate the effectiveness of their marketing strategies when applied to social media, following the framework of the recent 8 Ps approach (Dastak, Aligholi, 2014). The survey was conducted in 2014, and analysed no. 100 websites of agri-food companies selected on the Internet through the major search engines, as well as other information sources present on the Internet through specific and institutional links, selecting the sample based on a reasoned choice. The identification of the main parameters relating to the 8 Ps was performed through the use of a specific framework that has allowed information on different aspects that characterise the interactions between a company's marketing strategy and its social-commerce to be obtained in detail. In particular, the 8 Ps considered are the following: *product, place, price, promotion, people, process, physical evidence, productivity, and quality*; for each of these, a qualitative assessment using consolidated methods used in similar surveys was performed (Berthon *et al*., 2012; Bucca *et al*., 2006;Dastak *et al*., 2014; Sturiale *et al*. 2001; 2011).

The **second phase** aims to assess the consumer's ability to convey their purchasing intention to the community and social media, as a strategic element of *social-commerce* (Stephen *et al*., 2010; Scuderi *et al*., 2014 (a); Zou *et al*., 2013).

A specific questionnaire was used to interview 1,000 "followers" of the Facebook pages of the 100 agri-food enterprises that have been analysed. The questions given to the participating units, according to a specific experimental design, provide a number of scenarios that could generate three possible evaluations (of positive, negative, and neutral values) relating to consumer preferences and to the 8 Ps of companies' marketing strategies (that were previously assessed in the first phase).

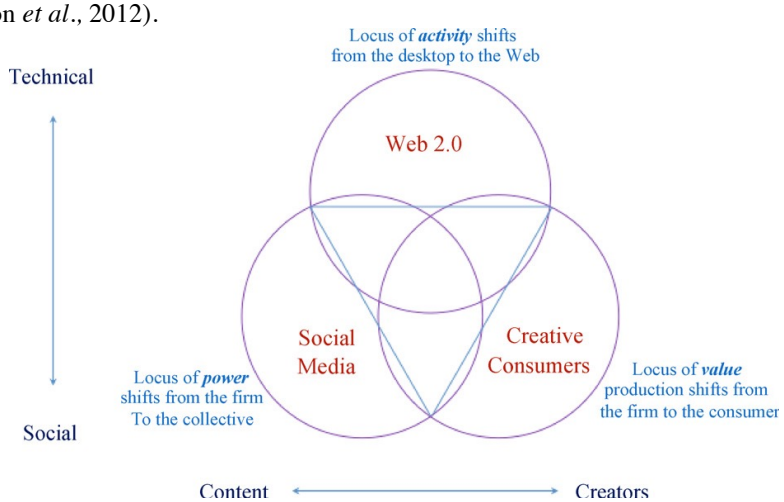
The collected data was processed by applying the technique of multiple regression analysis, in order to capture the influences from multiple independent variables on a dependent variable, according to the following base model in which all the variables analysed are contained:

SOCIAL probi= β0+ β1PRODUCT + β2 POS+ β 3 NEG+ β4MED+β5GENDER+ β6 POSTi+ β7WHYi+ β8AGEi+ β9EDU+ β10 PERS.f + εt

In which the various elements indicate the following: "SOCIAL probi" - the probability of transmitting the shopping experience to third parties; "i" - the individuals; "PRODUCT" - the type of product; "POS" - a positive experience; "NEG" - a negative experience; "MED" - a neutral experience; "GENDER" - the sex; "POST" - the activity of posting online by the participating entity; "WHY" - the motivation for posting online; "AGE" - the age; "EDU" - education; "PERS.f" represents the variable that recognises the individual characteristics of each respondent; and "εt" represents the forecast error/residue.

5 Results and Discussion

The results of the **first phase** of the research, following the 8 Ps marketing approach, has enabled the opportunities and limitations of the "e-business" models of in the agro-food system to be highlighted. Through the survey, some case histories of agri-food enterprises that have been able to maximise the opportunities offered by social media have emerged. In fact, they have adapted their methods of dealing with the customer, who, from being a simple content user, is becoming the author of content and experiences (a creative consumer), according to the interaction model between the web, social media, and consumer, as shown in the following image (Berthon *et al*., 2012).

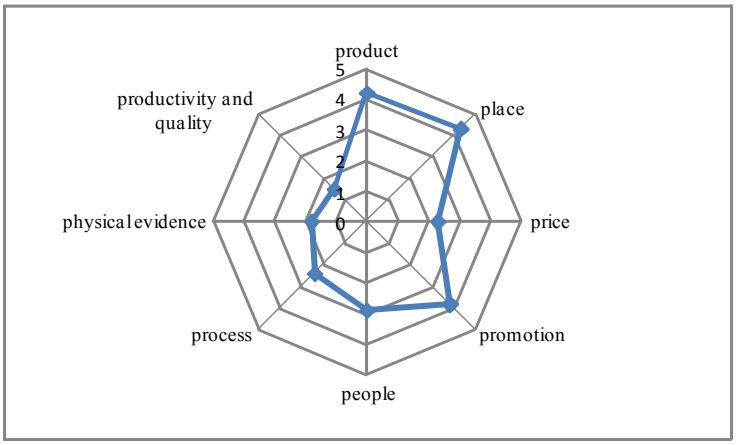


From the data obtained, it can be noted that marketing has transformed according to the characteristics of the new tool, and has focused its attention on "information" as a business asset, and on the business-client relationship in an integrated vision that can create value, transforming into *societing*. In this context, in the process of buying, the social media have become the most important instrument for directing both the online and off-line choices of buyers, also in the agri-food market (Scuderi, Sturiale, 2014(a); Sturiale, Scuderi, 2013).

In a competitive and highly dynamic environment, the essential sources of competitive advantage constituted by intangible factors are becoming increasingly important, since they allow companies to evolve, satisfy consumers, and anticipate change. For agri-food products, social media strategies have become an integral part of the development policies for the companies' products, with an additional attraction determined by the extent of investment, contact between the company and the consumer, and potential initiation of word of mouth in the community.

In summary, the objectives of the marketing strategies adopted by the companies analysed are to build, engage, and expand direct relationships with customers through the *social network*, to increase brand awareness, to gain more and more information in order to develop targeted communication, and to activate *social commerce*.

Fig. 1 The impact of maketing mix (8P's) for agrifood firms



However, the results highlight (Fig. 1) that businesses are open to the new "8 Ps" marketing approach in different ways. The majority of companies (63%) are still predominantly oriented to the original 4 Ps, even though they show an interest in the people element. On the other hand, the remaining Ps are largely unexplored or undervalued. There is, therefore, an interest in the new elements of the marketing model, but the process is still at its beginning. Therefore, both the actions and the results of the application of such elements are still to be assessed for "Made in Italy" agri-food products (Scuderi *et al*, 2014- b)..

Moving on to analyse the results of the **second phase**, that is the intention of transmitting the knowledge and the experience of purchasing through social media, it can be noted that the purchase of "Made in Italy" agri-food products generate a significant level of reporting. A positive experience generates more SOCIAL compared to a negative experience, and the latter induces, in turn, a greater desire to transfer such an experience than a mediocre one, for which, for both samples considered, all the statistically significant coefficients are negative. This means that the presence a mediocre experience has a negative effect on the desire to report information relating to the product or to the experience to a third party. The results are reported in detail in Tab. 2.

Tab. 2 Estimated structural parameters of opinions deriving from virtual and how they affect consumers on their intention to buy (buy_prob).

	Estimate	Std. Error	t value	Pr (>|t|)
(Intercept)	19.752	7.101	1.125	0,0351517
med_on	3.815	2.874	1.015	0,235897
pos_on	13.567	3.983	3.125	0,001125
no.rev	5.871	3.528	1.127	0,242931
post	4.285	1.584	2.985	0,000984
gender	- 904	2.154	- 858	0,115874
age	- 1.987	2.154	- 1.125	0,228754
edu	1.985	2.368	1.224	0,265287

The results obtained from the statistical analysis enable the following considerations to be singled out, for the products concerned:
- the perception of "Made in Italy" exceeds the value of the shopping experience, as it incorporates an intrinsic value of tradition, capable of generating emotion, which induce purchases that go beyond the purchase threshold of the individual;
- the intention to transfer their own buying experiences to third parties varies depending on whether it refers to products already known by the purchaser;
- the intention to refer their own buying experience to third parties varies depending on the origin of the message, in many cases preferring to spread the message in off-line channels as well, as this makes it possible to generate a comparison between infinite consumers.

These assessments confirm that word of mouth on the net (e-WOM) on agri-food products acts very effectively. *Social commerce*, which is based on communication, should therefore be included among the strategic elements of a *social media marketing* plan, integrated with the *omni-channel* strategy of companies, and assume a significant place in the sales strategy for agri-food products.

6 Conclusions

The environment created by the Internet has led to selection mechanisms for products that are very fast, with the elimination of competitors that do not have an appropriate business model.

To this end, it is essential to refer to an active and interactive model of web presence, which through analysis and review of business processes as a whole, takes into account the characteristics of the company, in this case the specificity of agri-food products and their local dimension, in order to generate a real source of competitive advantage in a global context. The ICTs offer great opportunities to the enterprises concerned, especially the tools of Web 2.0 and *social media*, as the survey reveals.

The *social commerce* for agri-food companies will become strategic for broadcasting the purchasing experience of "Made in Italy" foods, strongly anchored to territory, transforming into "*glocal social commerce*" (Scuderi *et al*., 2015) .

On one hand, the EXPO 2015 global event , and on the other hand, the trend of the international media towards broadcasting a format that is focused on cooking and

food, which are becoming a global viral phenomenon, are establishing food as the challenge of the future.

This is a historic moment that offers great potential for "Made in Italy" food enterprises, both in terms of image and of the tools offered for the communication of products on a global level. Focusing on social media, networking, and appropriate marketing strategies (8 Ps) and on *societing* will enable them to be more competitive in the marketspace. To this end, it will be important to develop appropriate models of *omni-channel "e-business*", in which constructing a targeted *social media marketing* will become strategic, to support "Made in Italy" agri-food products.

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Consumers' Purchasing Behaviour Patterns Regarding Organic Wine in a Southern E.U. Country

Lambros Tsourgiannis[1], Efstratios Loizou[2], Anastasios Karasavvoglou[3], Christos Antonios Tsourgiannis[4], Giannoula Florou[3]

[1]Region of Eastern Macedonia & Thrace, 67100 Xanthi, Greece,
e-mail: ltsourgiannis@gmail.com
[2]Technological Educational Institute of Western Macedonia, Dept. of Agricultural Products Marketing and Quality Control, Florina, Greece
[3]Accountancy and Finance Department, Eastern Macedonia and Thrace Institute of Technology, Kavala, Greece
[4]Ministry of Rural Development and Food, Centre for Seed Certification in Xanthi, Xanthi, Greece

Abstract. This paper aims to explore the consumers buying behaviour towards organic wine in Southern Europe and more precisely in Greece. The study attempts to compare its results with other studies concerning Northern European Consumers' attitudes shedding light in potential differences. Field interviews conducted in a randomly selected sample consisted of 510 consumers in November and December of 2013, were analyzed by employing multivariate statistical analysis. Principal components analysis (PCA) was conducted to identify the factors affecting people in preferring consuming organic wine. Cluster techniques employed to classify consumers with similar buying behaviour and identified three groups of consumers: the "conscious" consumers, the "curious" consumers, and the "opportunists". Discriminant analysis was performed to assess how the identified factors derived from PCA could predict cluster membership. Non parametric statistical tests were performed to profile the identified group of consumers regarding their demographic characteristics.

Keywords: Consumer behaviour, Organic wine, Consumer preferences

1 Introduction

1.1 Issue Under Study

Niche marketing has become the focus of many studies that examine consumers' acceptance of value added or differentiated products. Regarding food selection, consumers' behaviour and decision-making process is affected by numerous factors, such as: food quality characteristics, diet and health issues, price, governmental

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actions, cultural factors, distribution channels, etc (Tsourgiannis 2008). Additionally, religious prohibitions, cultural beliefs and counterculture attitudes have a significant influence on consumers purchasing decisions towards food products together with the social characteristics of the consumers (Lazaridis 2003).

In this framework the current study examines such a product; that is, organic wine, aiming to explore consumers purchasing behaviour patterns in Southern Europe and particularly in Greece. Most of the knowledge about the consumers attitudes regarding organic wine in Southern Europe mainly is derived from a limited number of studies conducted before the current economic crisis. Thus, the examination of the factors that affect the buying behaviour of South European consumers towards organic wine amidst the period of economic depression is very important and fills a gap in the relevant literature. More specifically, the study aims to identify the factors that affect consumers' purchasing behaviour and classify them into groups with similar behaviour as well as to profile each group of consumers regarding their demographic characteristics. Further, the study aims to compare its results with other studies concerning Northern European consumers' attitudes and sheet light in potential differences.

1.2 Literature Review

Consumers, especially in Europe where food safety crises stuck hardest, have partially lost their confidence towards many conventional farming products. Such a product is wine, according to Loureiro (2003) in the wine market, environmental quality perceptions seem to play a critical role in consumers' preferences. Many empirical studies examined the factors explaining organic food behaviour and profile and differentiate the organic consumer from the non organic one. Thompson and Kidwell (1998) found that families with children were more likely to buy organic food. Aertsens et. al. (2009) argued that health related to value security and taste related to hedonism can play an important role in determining organic food purchases. Environment and nature protection as well as animal welfare also motivate people in buying organic food (Aertsens et. al. 2009). Furthermore, a great deal of attention has been devoted to the design characteristics of the wine bottle (Mann e.t al, 2012).

While most consumers hold positive attitudes towards organic food the proportion of consumers purchasing organic food on a regular basis remains low, with market shares of organic products in European countries, being quite low in some Southern Central and Eastern European countries and quite high in Austria and Denmark (Aertsens, et.al 2009). Consumers are becoming more aware of quality issues linked to health, taste, environmental and ethical concerns (Ness et. al.2010). Moreover European consumers regarding organic market can be classified into established consumers, emerging consumers and non-consumers and therefore while there is a healthy market for organic food, purchasing patterns are not stable as consumers switch between purchase –frequent categories. Furthermore, organic shoppers have responded to the recent economic crisis by shopping less often, purchasing fewer premium products and switching to quality low-input food (Ness et. al.2010).

Consumers in Southern European Countries are influenced by the Mediterranean dietary patterns (Balanza et. al. 2007). More particular, Mediterranean consumers have developed a drinking culture according to which the sole use-value of alcohol is that of a nutrient. In other words, alcohol (mainly wine) is mostly drunk in connection with meals for its nutritional and gastronomic properties (Makela et. al. 2006); though, young people start following new wine consumption patterns, (Barena and Sanchez, 2009). On the other hand, Northern and Central European consumers are more influenced by the western diet that is rich in animal fat and protein and low in complex carbohydrates (Panza et al 2004) and their average volume of drinking is higher than in Southern Europe (Rehm et. al. 2003).

Studies conducted in Southern EU countries examined consumers' attitudes towards wine and organic wine purchases and indicated that these consumers pay attention to the quality of the wine, price, nutritional information on food labels, confidence in food quality controls made by authorities and private companies, health and diet issues, absence harmful substances, visual attractiveness of the product, influence of recommendations, presentation, publicity and previous knowledge (Crescimanno et. al. 2002; Fotopoulos et. al. 2003; Radman 2005; Barreiro-Hurle et al. 2007; Bernabeu et al. 2008; Kuhar and Juvancic 2010). They are also influenced in their buying decision towards organic wine by their age, household size, income, education (Crescimanno et. al. 2002; Chryssohoidis and Krystallis, 2005; Radman 2005; Tsakiridou et. al. 2006; Krystallis et. al. 2006).

The identification of the motives of Northern European consumers to buy organic food as well as the comparison of these motives with the motives of Southern European consumers, was the aim of a number of studies. In particular Northern and Western European consumers are influenced by the appearance, taste, eating experience, price, nutritional value, value for money, shelf life, keeping quality, origin of the wine, production system, colour of the wine, perceived status image, perceived satisfaction and perceived value; health and environment issues as well as by ecological motives (Fotopoulos and Krystallis 2002; Honkanen et. al, 2006; Adamsen et al., 2007; De Magistris and Gracia, 2008; Janssen et al. 2009; Ness et al. 2010; Mann et al., 2012;).

Many consumer behaviour theories and models have developed the last decades to examine issues as above. The food-related lifestyle (FRL) has been proposed as a mediator between and behaviour (Brunso & Grunert, 1995; Brunso et al., 2004a; Brunso et al., 2004b; Grunert, et. al., 1997; Scholderer, et. al., 2002). Attitude and decision making research has examined what might be considered "cold" and "hot" aspects of consumer behaviour (Simonson et al. 2001). Social recognition and Behavioural Decision Theory (BDT) in consumer research have tended to build on different underlying models of buyer behaviour and the communication process (Simonson et al. 2001). Furthermore, according to the Theory of Reasoned Action (TRA) people consider implications of their actions before they involved in a given behaviour (Ajzen and Fishbein 1980). Therefore, as Papista and Krystallis (2012) argued, people form intentions to perform behaviours that are intercepted by persons attitudes towards that behaviour and social norms. As this model criticized that failed to support the connection between intention and behaviour (Gupta and Ogden, 2009); Ajzen (1991) developed the Theory of Planned Behaviour (TRB) which argues that the intention of a person to perform an action is the most important immediate

determinant of the action. This theory found application and in consumers' decision making process and buying behaviour regarding sustainable food consumption (Aertsens et. al. 2009; Arvola et. al. 2008; Toulouse et. al. 2006; Vermeir and Verbeke 2008).

On the other hand, the above mentioned consumer behaviour theories and models do not take into consideration all the intrinsic and extrinsic characteristics and values, marketing mix issues and demographic characteristics in exploring the factors that affect consumers purchasing behaviour but each theory and model some of them. Therefore, a conceptual model was developed in the current study to place the intrinsic and extrinsic characteristics and values, marketing mix issues and demographic characteristics outlined in the literature into an identifiable framework (Figure 1).

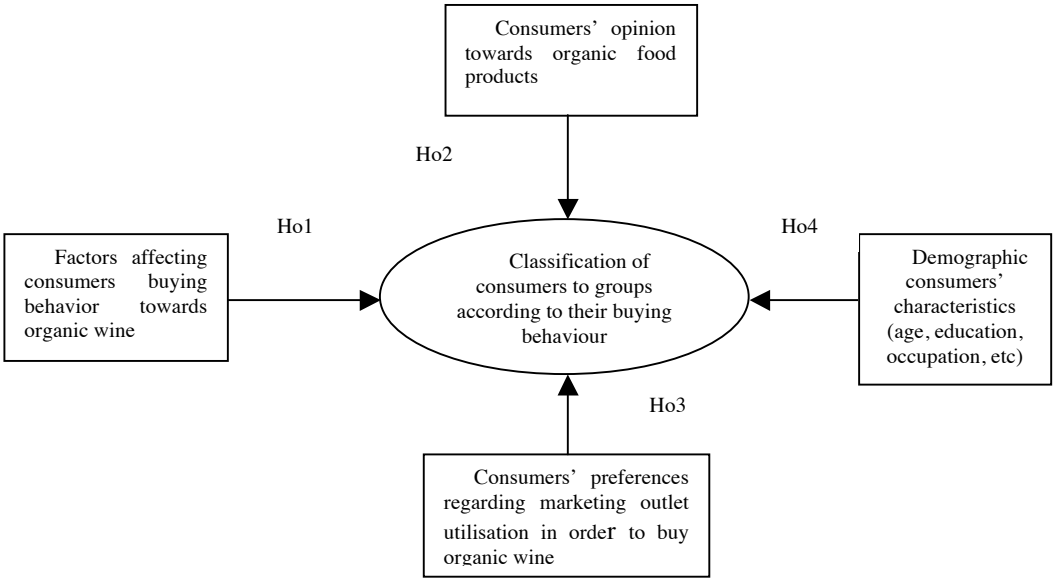

Fig. 1. The Conceptual Model

The research null hypotheses that this study tests according to the conceptual model below are the followings: **Ho1**, consumers in Greece cannot be classified into groups according to the factors that affect their purchasing behaviour towards organic wine. **Ho2**, consumers' opinion about the organic food products is not significantly related to particular purchasing behaviour. **Ho3**, consumers' purchasing behaviour towards organic wine is not significantly related to their preferences regarding the utilisation of a particular marketing outlet. **Ho4**, consumers' purchasing behaviour towards organic wine is not significantly related to their demographic characteristics.

In the introductory section above the current study presented the topic under examination, the gaps in the literature and its aims and a comprehensive literature review on organic food products consumers' perceptions along with a comparison of

the differences between Southern and Northern Europe consumers. The applied methodology is analysed in the next section with a brief presentation of the survey procedure; the results are presented next analytically following the research questions and in the end conclusions are discussed.

2 Applied Methodology

2.1 Survey Procedure

The survey of the study addressed to a sample of consumers in order to gather data necessary to identify the factors that affect consumers buying behaviour towards organic wine, in Greece. Hence, the research focuses on a sample of Greek consumers, purchasers of organic food products. Information were gathered through an interview survey as the consumers are familiar with this kind of research and their educational level is suitable for the use of this kind of survey method (Oppenheim 2000). Additionally, the cost of conducting large postal or telephone survey to develop a typology was considered prohibitive. Furthermore, as many consumers do not have an Internet access, the electronic survey method was not suitable for surveying a representative to a general population sample.

Cluster sampling method used to form the sample. In particular the general population is stratified into two levels: regions and prefectures. Initially based on the methodology presented by Oppenheim (2000), from the 13 regions exist in Greece 11 regions selected at random order to have a more representative sample from the geographical point of view. In the second stage 1 prefecture from each region selected at random. Finally, a random systematic sampling was used to form the sample of 50 consumers in each prefecture and more particular in the capital of each chosen prefecture where shopping malls, supermarkets and market exist by taking every sixth person that came on site (McCluskey et. al., 2003). As Errington (1985) argued the only way in which this can be achieved is to ensure that the units for survey are selected at random from the larger population about which generalizations are to be made. The productive sample consists of 510 consumers that would be reasonably representative of some larger population about which useful generalization could be made. The size of the sample is considered reasonable regarding the total population of the area as this size of samples were mostly used by other researchers in Greece regarding consumer behaviour towards food purchases (Tzimitra-Kalogianni et.al.1999; Botonaki and Tsakiridou, 2004; Tsakiridou et al. 2008).

An effort was made to reach consumers at the same time and place where actual purchase decisions are made hoping to better elicit consumers' true preferences about the products. Interviews took place throughout the day to reduce time of shopping related bias (Krystallis and Chryssohoidis, 2005). Hence, one quarter (25%) of the interviews were conducted between 9:00 – 15:00 during the week (Monday – Friday), one quarter between 15:00 – 21:00 during the week and 50% during

Saturday (9:00 – 19:00). This survey methodology developed according to the results of the pilot survey into which the respondents indicated the day and time they make their shopping.

The representativeness of the sample immunized by checking the proportion of the consumers of the sample who declared that bought organic food with those of the pilot survey. In particular, the proportion of consumers (p) in the pilot survey who indicated that bought organic wine at least once is 92%. Therefore in order to achieve a representative sample the sample size should be 265 consumers (in order have z=3 and d=5%). As the researchers decided to a sample size 550 consumers (about two times more than what was needed) in order to have similar size samples with other surveys presented above, and the proportion of consumers who bought at least one time local food in this sample is about 92% (510 consumers), the sample is considered representative.

2.2 Questionnaire design

Factors that affect the consumers' behaviour towards organic wine were identified by the researchers after searching the literature. Furthermore they designed a questionnaire in order to meet the research objectives and pre-tested it in academics, food marketing experts and consumers. In the next stage the questionnaire was piloted in October of 2013 to 100 consumers. The pilot survey indicated that no modification needed to the questionnaire and therefore the main survey was conducted in November and December of 2013 as mentioned above.

2.3 Statistical Methodology

Multivariate analysis techniques were used to the 510 consumers that buy organic wine to reveal the key information contained in the responses, and these analyses were applied in three stages. First, principal component analysis (PCA) was used to identify the variables that accounted for the maximum amount of variance within the data in terms of the smallest number of uncorrelated variables (components). The anti-image correlation matrix was used as well as Bartlett's test of sphericity and measure of sampling adequacy (MSA) in order to check the appropriateness of the data for subsequent factor analysis. The variables that had a high proportion of large absolute values of anti –image correlations as well as MSA less than 0.5 were removed before analysis. In this study, PCA reduced the key attitude variables, which relate to various aspects of consumers behaviour towards organic wine, to a smaller set of underlying factors (or consumption dimensions). An orthogonal rotation (varimax method) was conducted and the standard criteria of eigenvalue=1, scree test and percentage of variance were used in order to determine the factors in the first rotation (Hair et al. 2010). Different trial rotations followed where factor interpretability was compared. These factor scores were then subjected to cluster analysis to group consumers with similar patterns of scores into similar clusters based on their buying behaviour. In this study, both hierarchical and non-hierarchical methods were used according to the recommendations of Hair et al. (2010) and

Karelakis et al. (2011) in order to develop a typology of the consumers' buying behaviour. A non-parametric Kruskal–Wallis one way ANOVA was conducted to validate the cluster solutions by examining if variables not used in cluster analysis differ significantly among the identified clusters.

Quadratic discriminant analysis was performed to assess how accurately the identified key consumption dimensions that were derived from the factor analysis could predict and discriminate cluster membership. Statistical tests based on the outcomes of the multivariate statistical techniques presented above (factor, cluster and discriminant analysis) were used to test the four hypotheses presented in previous section.

3 Results

3.1 Consumers' buying behaviour and attitudes towards organic wine.

Principal components and factor analyses (through a varimax rotation) were conducted to identify the key consumption preference variables, and the latent root criterion (eigenvalue =1), the scree plot test and the percentage of variance were used to determine the number of factors (Table 1). Several different trial rotations were conducted to compare factor interpretability as suggested by Tabachnick and Fiddell (1989) and Hair et al (1998).

Table 1: Results of Principal Component Analysis regarding Consumers buying attitudes

Component	Eigenvalue	%Variance	%Cumulative variance	Variables	Communalities
1	**2.271**	**37.842**	**37.842**	V1 - Environment protection	0.630
2	**1.402**	**23.366**	**61.208**	V2 – Nutritional Value	0.586
3	0.736	12.272	73.480	V3 – Absence of Chemical Ingredients	0.592
4	0.629	10.475	83.955	V4-Quriosity	0.684
5	0.505	8.418	92.374	V5-Prestige	0.691
6	0.458	7.626	100.00	V6-Health protection	0.502

KMO MSA = 0.682, Bartlett test of Sphericity = 545.352, P <0.001

PCA identified two factors that affect consumers' preferences towards organic wine (Table 2).

Table 2. Main Factors affecting consumers preferences towards organic wine

KEY CONSUMPTION DIMENSIONS	Factor Loadings
Health Safety	
Environment protection	0.793
Absence of Chemical Ingredients	0.766
Nutritional Value	0.762
Health protection	0.659
Prestige and Curiosity	
Prestige	0.829
Curiosity	0.827

In the next stage, hierarchical and non-hierarchical clustering methods were used to develop a typology of the buying behaviour of the consumers in Greece (Helsen and Green, 1991 and Hair et al., 2010). Cluster analysis was conducted on the 510 observations, as there were no outliers. It identified three groups of consumers that were named according to their buying behaviour patterns towards organic wine (Table 3).

These are: (a) the **"curious"** consumers, (b) opportunists and (c) the "conscious" consumers. In particular, the "curious" consumers comprise the 19% of the sample and are mainly influenced in their buying decisions towards organic wine only by prestige and curiosity. Some other factors that influence them in this purchasing decision are the absence of chemicals additives, nutritional value of the products and the environmental impact of the production process of the product. On the other hand, the **"opportunists"** consists of the 26% of the sample. These consumers although they purchase organic wine they are not influenced by any particular factor. The **"conscious"** consumers comprise 55% of the sample. These consumers are interested in buying products with no chemical additives. Furthermore, the environmental consequences of the product as well as the nutrition value of the product are also some factors that affect consumers buying behaviour. Hence they buy organic wine consciously as they consider it healthier and environmental friendly.

Table 3. Characteristics of the Three Consumers' Groups

Key Consumption Dimensions	"Curious" Consumers	"Opportunists" Consumers	"Conscious" Consumers	P
Health safety	0.34501	-1.36372	0.52825	0.0001
Prestige and curiosity	1.58335	-0.20174	-0.45269	0.0001
Number of consumers (n=510)	**97**	**133**	**280**	

Furthermore these three groups of consumers were validated using Kruskal – Wallis non-parametric one-way ANOVA with four (4) consumption variables describing the way they buy organic wine and were not used in factor analysis; as this test is more robust in cases of ordinal data (Kinnear and Gray 2000). As Table 4 illustrates the three identified consumers groups found to good validity as the examined variables are significant associated with consumers' buying behaviour towards organic wine. In particular the **"Conscious"** consumers in comparison with the **"curious"** consumers are more affected in their organic wine purchasing decision by the quality, taste and advertisement of the product, whilst the **"curious"** consumers pay more attention to the topicality of the product.

Table 4. Miscellaneous Characteristics of the Three Consumers Groups according to Kruskal–Wallis test

Miscellaneous Characteristics	"Curious" Consumers	"Opportunists" Consumers	"Conscious" Consumers	P
Quality	267.2^{a}	172.0^{a}	291.10^{a}	0.0001
Taste	274.7^{a}	169.8^{a}	289.6^{a}	0.0001
Topicality	327.7^{a}	191.1^{a}	261.10^{a}	0.001
Advertisement	140.8^{a}	128.6^{a}	150.8^{a}	0.001
Number of consumers (n=510)	**97**	**133**	**280**	

NB: Average ranks with similar superscripts among groups per line (characteristic) differ at $P<0.05$

Moreover discriminant analysis was conducted to evaluate the prediction of group membership by the predictors derived from the factor analysis. Initially the normality of the key strategic dimensions was checked. The Box's M test statistic (Box M= 95.053 approx F= 15.730 df =6 $P<0.001$) indicated that the variance – covariance matrices were violated. The summary of the cross validation classification derived by the quadratic discriminant analysis is shown in Table 5.

Table 5 Summary of Classification with Cross - validation

Actual Classification	**Predicted Classification**		
	"Curious" Consumers	**"Opportunists" Consumers**	**"Conscious" Consumers**
"Curious" Consumers	97	0	3
"Opportunists" Consumers	0	133	21
"Conscious" Consumers	0	0	256
Total N	97	133	280
N correct	97	133	256
Proportion of Correct Classification	100%	100%	91.4%
N=510	N correct = 486	Proportion Correct =95.3%	

Thus, the two consumption dimensions could accurately predict and discriminate consumers' group membership.

Therefore, the hypothesis ***Ho1:*** *Consumers in Greece cannot be classified into groups according to the factors that affect their purchasing behaviour towards organic wine* may be rejected.

3.2 Consumers Opinion Towards Organic Food Products

In the next stage, nominal logistic regression analysis was performed to in order to identify the main opinion of each group of consumers towards organic products. In particular, the analysis indicated (Table 6) that "opportunists" contrary to the "conscious" consumers although they believe that organic food have better quality and more nutritional value than conventional, these attitudes do not influence them positively in their shopping towards organic food. On the other hand, most of the "curious" consumers in comparison with the "conscious" although they believe that conventional food in general are better than organic they consider organic food tastier than conventional. Besides, their attitudes that organic food products are more expensive than conventional influence them negatively in their purchasing decision in comparison with the "conscious" consumers.

Table 6. Consumers' opinion about organic products

	Predictors	Coef	P	Odds ratio
Opportunists/Conscious	Constant	5.562	0.001	
	Conventional food products are better than organic	0.2721	0.050	1.31
	Organic food products are tastier	0.0252	0.884	1.03
	Organic food products have better quality	-0.7156	0.001	0.49
	Organic food products are healthier	0.2412	0.222	1.27
	Organic food products are more expensive	0.0087	0.956	0.99
	Organic food products have more nutritional value	-0.4777	0.005	0.62
	Organic food products do not have negative impact on the environment	-0.9199	0.001	0.40
Curious/Conscious	Constant	0.165	0.889	
	Conventional food products are better than organic	0.2906	0.026	1.34
	Organic food products are tastier	0.4548	0.006	1.58
	Organic food products have better quality	-0.0726	0.731	0.93
	Organic food products are healthier	-0.3000	0.157	0.74
	Organic food products are more expensive	-0.3619	0.011	0.70
	Organic food products have more nutritional value	0.0851	0.639	1.09
	Organic food products do not have negative impact on the environment	-0.1459	0.294	0.86
	Log-likelihood = -417.657			
	G=179.976; DF=14; P<0.001			

Thus hypothesis**,** ***Ho2:*** *Consumers' opinion about the organic food products is not significant related to particular purchasing behaviour* maybe rejected.

3.3 Consumers' Marketing Channel Utilisation regarding organic wine purchases

The researchers in their effort to explore which marketing outlet the consumers of each group usually prefer conducted the chi-square analysis. According to the results of the test (Table 7) the consumers of all the three groups have similar behaviour

regarding the marketing outlets they use in order to buy organic wine . In particular most of them usually buy organic wine from wine cellars.

Table 7. Consumers' marketing channel utilisation regarding organic wine

Marketing channels	**"Curious" Consumers**		**"Opportunists" Consumers**		**"Conscious" Consumers**	
Wine Cellars	(x^2 =43.633, df=2 P<0.001)	64.9%[a]	(x^2=15.535, df=2 P<0.05)	46.6%[b]	(x^2=115.340, df=2 P<0.001)	62.5%[a]
Special Shops that sell Organic Food		17.6%[c]		34.6%[b]		11.8%[a]
Supermarkets		17.5%[c]		18.8%[a]		25.7%[b]

[a]P<0.001, [b]P<0.01, [c]P<0.05 and n.s P>0.05

Hence, the hypothesis ***Ho3*** *Consumers' purchasing behaviour towards organic wine is not significantly related to their preferences regarding the utilisation of a particular marketing outlet* maybe rejected.

3.4 Profiling each consumer group according to consumers' demographic characteristics.

A chi-square analysis was also performed for each consumer group in order to develop the profile of the consumers who have a particular buying behaviour towards organic wine regarding their demographic characteristics. As Table 8 indicates most of the "curious" consumers are between 30-44 years old, hold a bachelor degree, have 1-2 children and work as private employees or as civil servants. On the other hand, most of the "opportunists" consumers are between 30-44 years old, hold a high school of a bachelor degree, do not have children and are free licensed. Furthermore, the majority of the "conscious" consumers are between 30-44 years old, hold a university degree, are married with 1-2 kids and work as free licensed.

Table 8. Consumers' profile regarding demographic characteristics.

Marketing channels		"Curious" Consumers		"Opportunists" Consumers		"Conscious" Consumers	
Age	20-29 years	(x^2= 40.031, df=3 P<0.001)	23.7% n.s	(x^2= 48.732, df=3 P<0.001)	25.6% n.s	(x^2= 96.486, df=3 P<0.001)	17.9% a
	30-44 years		48.5% c		48.1% c		46.1% c
	45-64 years		24.7% n.s		20.3% n.s		29.6% n.s
	>65 years		3.1% c		6.0% c		6.4% c
Education	Primary School	(x^2=27.485, df=4 P<0.001)	11.3% n.s	(x^2=39.143, df=4 P<0.001)	14.3% n.s	(x^2=136.143, df=4 P<0.001)	9.6% c
	Secondary School		13.4% n.s		11.3% a		12.1% b
	High School		27.8% n.s		33.1% c		38.2% c
	Bachelor degree		37.1% c		33.1% c		35.4% c
	Postgraduate degree		10.3% a		8.3% b		4.6% c
Marital Status	Not Married	n.s.	41.2% n.s	n.s.	42.1% n.s	(x^2=54.914, df=1 P<0.001)	27.9% c
	Married		58.8% n.s		57.9% n.s		72.1% c
Number of Children	No children	(x^2=8.317, df=2 P<0.05)	39.2% n.s	(x^2=21.905, df=2 P<0.001)	44.4% a	(x^2=102.762, df=2 P<0.001)	28.9% n.s
	1-2 children		41.2% n.s		41.4% n.s		59.6% c
	+3 children		19.6% a		14.3% c		10.7% c
Occupation	Private employee	(x^2=24.523, df=6 P<0.001)	24.7% b	(x^2=57.053, df=6 P<0.001)	27.1% c	(x^2=55.350, df=6 P<0.001)	20.4% b
	Civil Servant		24.7% b		15.0% n.s		21.8% c
	Free Licensed		15.5% n.s		29.3% c		22.5% c
	Retiree		5.2% a		6.8% a		10.0% n.s
	Student		9.3% n.s		10.5% n.s		17.5% b
	Unemployed		9.3% n.s		4.5% b		8.9% a
	Other		11.3% n.s		6.8% c		8.9% a

[a]P<0.001, [b]P<0.01, [c]P<0.05 and n.s P>0.05

Therefore the hypothesis ***Ho4:*** *Consumers' purchasing behaviour towards organic wine is not significantly related to their demographic characteristics* maybe rejected.

4 Discussion - Conclusions

This study provides, from a theoretical perspective, evidence on factors that influence the intention to purchase organic wine, extending evidence to European consumers and give useful information to local policy makers to promote the future development of the demand for organic wine in a Southern E.U. Country. Results indicated that there was a significant association between the adoption of a buying behaviour and the factors, opinions and personal characteristics that influence them to choose organic wine.

It was also found that the consumers who prefer to buy organic wine wittingly consider it healthier, with no chemical ingredients, with no negative impact on the environment, tastier and with better quality in comparison with the conventional products. "Curious" consumers on the other hand consider the organic wine healthier and with no chemical ingredients and no negative impact on the environment than the conventional. They also pay attention in product's topicality but they are mainly influenced in their purchasing decision towards organic wine by their curiosity and the prestige they will gain by buying these products. Moreover all the three groups of consumers prefer to buy organic wine from wine cellars. Therefore, this study supports the findings of other studies (Cresimento et al 2003, Radman 2005, Barreiro – Hurle et al. 2007, Bernabeu et. al. 2008) according to which Southern European consumers are mainly affected in their preferences towards organic wine by health and quality issues. Furthermore this study indicates that existence of a family, occupation and educational level affect consumers' purchasing behaviour towards organic wine and hence supports the findings of Tsakiridou et. al. (2006) and Chryssohoidis and Krystallis (2005).

On the other hand, this study indicates that most of the organic wine consumers in Greece are influenced in their choice by environmental and nutritional issues, whilst these factors do not motivate mainly the Southern European Consumers. This finding suggests that the motives of Greek organic wine consumers are switching and becoming similar to that of North European consumers who mainly buy organic food due to their environmental concern and the nutritional value of the product (Ness et al. 2010, Mann et. al. 2012, Janssen et. al. 2009) maybe because most of the organic wine consumers in Greece who in their vast majority are between 30-44 years old have studied in Northern and Western European Countries. Moreover, the supermarket sector in Greece is dominated by multinational supermarket chains and therefore, the last few years there is availability of organic food including wine in supermarkets except the specialty shops and wine cellars. Hence, even most of the consumers prefer to buy organic food from wine cellars there is about a 18%-25% of consumers who purchase organic food from supermarkets as Northern European consumers usually do.

Moreover, the fact that the mentioned in the literature review consumer behaviour theories and models including the food-related lifestyle (FRL), social cognition and behavioural decision theory (BDT), theory of reasoned action (TRA) and theory of planned behaviour (TRB) (Aertsens et. al. 2009; Ajzen and Fishbein 1985; Ajzen 1991; Arvola et. al. 2008; Brunso & Grunert, 1995; Brunso, et.al.2004a; Brunso, et.al.2004b; Grunert, Brunso, & Bisp,1997; Scholderer, Brunso, & Grunert, 2002, Simonson et al. 2001; Toulouse et. al. 2006; Vermeir and Verbeke 2008) do not take into consideration all the above mentioned attitudes, values and characteristics, supports the validity and novelty of the conceptual model developed and used in this study.

A number of limitations can be identified in this survey with the most important being the followings: a) Some answers in the questionnaire may not represent the true beliefs and attitudes of consumers due to the fact that they are asked in the place and at the time they make their shopping and their time to answer the questionnaire is sometimes limited. Of course this limitation exists in most of consumers preferences surveys. b) The samples in such surveys cannot be quite large due to financial constrains. Though, a larger sample covering the whole country or even better a sample from various Southern EU countries that would provide much accurate results can be the aim of a future study. c) The adopted statistical methodology even it explore the factors that affect consumers' buying behaviour and create a taxonomy of consumers with similar buying behaviour (which is the purpose of the current study) useful for marketing analysis and strategy development cannot measure the demand of a product or determine the importance of the characteristics of a product that affect consumers' behaviour. These measurements can be made with the use of other statistical techniques such as conjoint analysis and contingent valuation, thus a future research employing such techniques may result in more comprehensive and integrated outcomes. Policy makers and relevant stakeholders may found very useful information regarding the demand for such products through the estimation of demand elasticities.

Nevertheless, the value of the current study is incontestable. It is the first study that explores consumers' attitudes towards organic wine in Southern Europe and more particular in Greece during the recent economic crisis. Moreover, consumers' choice processes are no longer based entirely on their knowledge of the product but on their knowledge of themselves (Barena and Sanchez 2009). Therefore, this study provided details on the consumers profile regarding their organic wine purchases and broadens the range of available marketing information and options. From a managerial perspective, according to the results of this study the local producers in Greece should focus on the production of organic wine in order to add value to their products and differentiate them from the products produced in other areas or imported from other countries and launched in very low prices by supermarkets and other retailers. Furthermore, they should structure their marketing and promotion mix and focus on the factors and consumers characteristics presented above. In particular they should target to those interested in health safety and environment protection, in product's taste, nutrition value, quality as well as to those that are influenced by psychological factors such as prestige and curiosity, by health safety issues and the locality of the product. They should certify and label their products as organic and differentiate them according to this quality certification. For

example in Denmark all farmers who sell their products as organic must be authorized. The Plant Directorate inspects farms and Food Directorate inspects processing and Trading (United Nations 2008). Moreover a systematic promotion of the organic food products should be undertaken by all the involved stakeholders within the value chain of the products in order to motivate consumers to prefer such products. The National Organic Agriculture Programme of the Ministry of Agriculture and Livestock (PNAO) in Costa Rica coordinates actions with both supermarkets and farmers' markets to assist in the inclusion of new suppliers to these markets as well as to support financially the promotion of activities such as national fairs and festivals (United Nations 2008). According to the same source, in Denmark the organisation "Organic Denmark" that consists of the main non-profit association for organic farmers, manufactures and consumers has been the main actor in most of the campaigns regarding information, marketing, export and so forth, often in very close cooperation with the main companies and retail stores with organic farming and organic products. This systematic promotion should include advertisement and campaigns organised by the local authorities and consumers organisations and hence they will also comply with E.U. promotion campaign for organic food. The Chilean Association for example was created in 1990 to promote the organic sector in Chile. It has approximately 90 members including farmers, certifiers, traders, consultants, students, professionals and others while it has been recognized as a valid representative for the organic sector by governmental bodies. Furthermore the Ministry of Agriculture in Chile has constituted a group, with public and private actors involved in the organic sector, to coordinate actions for developing organic agriculture (United Nations, 2008). They will also contribute to the Green Economy and the development of niche market products such as the local certified and organic food. Therefore, consumers may spend their money within the framework of the local economy buying local produced products instead of imported and will contribute in this way to the relation of the local economy that suffers so much due to the recent economic crisis. Furthermore, society as a whole, will gain from the growth of organic sector as organic food production creates fewer environmental externalities than conventional food production.

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The Use of Modern Tools of Business Management and Marketing In the Food and Beverage Field as a Prerequisite for Sustainable Development and Respect for the Environment

Georgios Tsekouropoulos[1], Nikolaos Katsonis[2], Vasiliki Tsekouropoulou[3], Dimitrios Theoharis[4]

[1]Researcher. PhD. in Marketing – Consumer Behavior, Aristotle University of Thessaloniki, Greece, e-mail: geotsek@mycosmos.gr
[2]Director of DIEK Thermis Thessalonikis- PhD candidate, University of Patras, Greece, e-mail: nikoskatsonis@gmail.com
[3]Vocational trainer – Expert in i-Treasures E.U. Programme, University of Macedonia, Greece, e-mail: vtsekouropoulou@yahoo.gr
[4]Marketing Executive-MSc in Digital Marketing, Greece, e-mail: dimitris.theoharis@yahoo.com

Abstract. Network technologies, modern organizational and marketing functions have transformed the way businesses operate nowadays and consequently have an effect on all sectors of the economy. Contemporary firms become members of the Internet society since the profits are high and innovative wireless broadband technologies allow to serve customers globally 24/7 while the relative cost keeps lessening (Andreopoulou, 2013). Internet constitutes a thriving means to promote a firm and can incorporate advertising and marketing activities, Total Quality Management, Corporate Social Responsibility, social media promotion, communication features in the firm's website. Nevertheless, Social responsibility, green marketing and environmental sustainability are becoming important practices for modern firms influencing the formulation of different types of corporate environmental practices within a green firm strategy (Tsekouropoulos et al, 2014). While many food and drink firms have already their online store through their website presentation, this paper aims to describe the modern organizational and marketing challenge in contemporary firms and the new trends (Werther and Chandler, 2006). An Internet search was conducted in eighty large firms that operate in food and drink sector in the prefecture of Central Macedonia, Greece. Their websites are analyzed and their features, such as CSR, advertising, marketing, consumer's behavior, social media etc are studied (Andreopoulou et al, 2014).

Keywords: marketing, Internet, business plan, total quality management, promotional activities, social responsibility

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1 Introduction

Modern businesses have to face multiple and significant challenges, due to market globalization, increasing competitiveness among businesses and a constantly changing business environment. Recently, the appreciation of supply chain as an innovative solution for successful business has been a great change and challenge for the businesses' operation (Tzoulis and Andreopoulou, 2013). Today, a customer can select between a wide range of high-quality products or services and the firm need to practice strategies to keep existing customers and attract new. Customers are familiar and at ease with information technology, such as using the Internet for their purchases. Information and Communication Technologies (ICTs) offer massive prospects and opportunities for every one to benefit, while new scenarios appear for economic development, improved service delivery and social advances (Andreopoulou, 2013). Within that aspect, Internet provides to the business sector, an additional opportunity to promote their products and services to potential customers globally (Andreopoulou et al. 2012).

Contemporary firms become members of the Internet society since the profits are high and innovative wireless broadband technologies allow serving customers globally 24/7, while the relative cost keeps lessening. The approach to these customers and the development of their trust towards the firm can be achieved through the quality, the comfort of markets, the price competitiveness and the offer of right products and services (Tsekouropoulos, 2009).

Many companies have already created websites and they consider internet a powerful tool within the competitive business environment. The website can be the storefront of a company and therefore it should always operate efficiently and have the adequate style and image that will attract and preserve its visitors and future customers (Andreopoulou et al. 2011). Apart from the presentation of products and sales methods, companies include in their official firm's websites, administration functions such as business plans, organizational structure and quality assurance systems. Also companies, about marketing and promotion of their products and services, include functions about advertising, public relations and social responsibility features (Tsekouropoulos et.al., 2013, Vlachopoulou, 2003).

Internet features have significantly contributed to the automation and reduction of the production process cost and the internal business administration and marketing processes (Tsekouropoulos et.al. 2012). At the same time, they add to the expansion of contact with the customers and to the increase of the supply chain. According to Canavari et al. (2008), "e-business includes a number of functions that vary in complexity and are defined as the use of the internet or other electronic means, for the execution of transactions, the support of business operations and the improvement of cooperation between the entities of the supply chain". In particular, the term of entrepreneurship can be defined as an attempt to convert the initiative into effect with the ultimate aim of producing a profit (Cunningham and Lischeron, 1991). Yet, a critical requirement is to successfully use the tools of management and marketing (Tsekouropoulos et al, 2013).

Social responsibility programs, funds and sponsorships are presented in a firm's website as an effort to inform the public and potential customers that the firm, apart

from the business part related to the cost, intends to return profit to the society (Tsekouropoulos et al., 2013). The social responsibility in a firm can be distinguished as 'internal' and 'external', depending on the beneficial parties of a corporate action. The managers have to penetrate to the core of the firm and to identify the strategic internal and external factors that determine both the firm viability and the sustainable development, by adopting practices of corporate social responsibility (Kotler, 2009).

The natural environment is progressively seen as a integrated level of CSR. Research on CSR and environmental sustainability in the management literature, is often converging because of shared environmental, economic, and social concerns, while environmental responsibility can be analyzed through a number of factors, such as the existence of anti-pollution programs, the extent to which a firm contributes to the conservation of natural resources, involvement in voluntary environmental rehabilitation initiatives, environmental friendly practices and the methodical reduction of waste and emissions from various operations (production, logistics, etc) (Montiel, 2008).

2 Data Analysis of Drink and Food Companies

The sample of the research is primarily going to be consisted of 80 respondents/companies. All of the subjects will be English speakers and managers or marketing managers of the firms. A non-probability judgmental/purposive sampling is going to be used as a sampling method. The choice of the particular sampling method was made with regard to the recruitment of the participants in the research as well as the choice of the respondents was made from a particular sampling frame which include all the companies of the area.

2.1 Data analysis

The analysis of the data was made with the statistical software for data analysis SPSS. Descriptive statistics will be used to illustrate the answers of the respondents while inferential statistics (x2) will be used to examine the relationship between the variables.

- Type of products/ Business or Marketing plan

Table 1 and figure 1 show the frequencies and percentages of companies that use business and marketing plans in relation with the type of their products. Specifically, most of the companies which sell drink products or a combination of drink and food products do not use business and marketing plans, while the bigger percentage of the companies who trade only food products have applied marketing or business plans.

Table 1. Type of products/ Business or Marketing plan

			Business or Marketing plan		Total
			No	Yes	
Type	Food	Count	3	4	7
		%	42.9%	57.1%	100.0%
	Drinks	Count	31	19	50
		%	62.0%	38.0%	100.0%
	Food & Drinks	Count	17	6	23
		%	73.9%	26.1%	100.0%
Total		Count	51	29	80
		%	63.7%	36.2%	100.0%

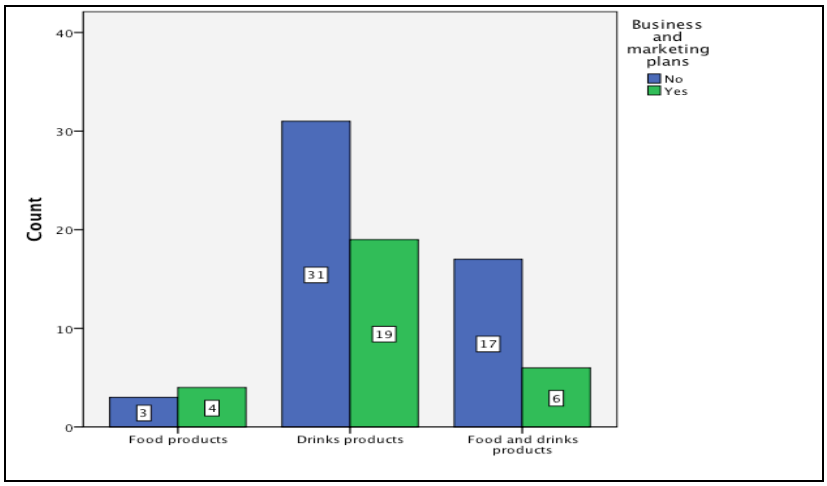

Fig. 1. Type of products/ Business or Marketing plan

- Type of products / Total Quality Management ISO HACCP

Table 2 and figure 2 show the frequencies and percentages of companies that use Total Quality Management practices in relation with the type of their products. Specifically, most of the companies which sell food or drink products do not use Total Quality Management practices, while the bigger percentage of the companies who trade both food and drink products have applied Total Quality Management practices.

Table 2. Type of products/ Total Quality Management ISO HACCP

			Total Quality Management ISO HACCP		Total
			No	Yes	
Type	Food	Count	3	4	7
		%	42.9%	57.1%	100.0%
	Drinks	Count	18	32	50
		%	36.0%	64.0%	100.0%
	Food & Drinks	Count	15	8	23
		%	65.2%	34.8%	100.0%
Total		Count	36	44	80
		%	45.0%	55.0%	100.0%

Moreover, from the application of $\chi 2$ test, it was found that there is a statistical significant relationship between the type of the products and the application of total quality management (sig.= 0.046).

Table 3. Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.448	2	.046
Likelihood Ratio	5.480	2	.065
Linear-by-Linear Association	3.430	1	.064
N of Valid Cases	80		

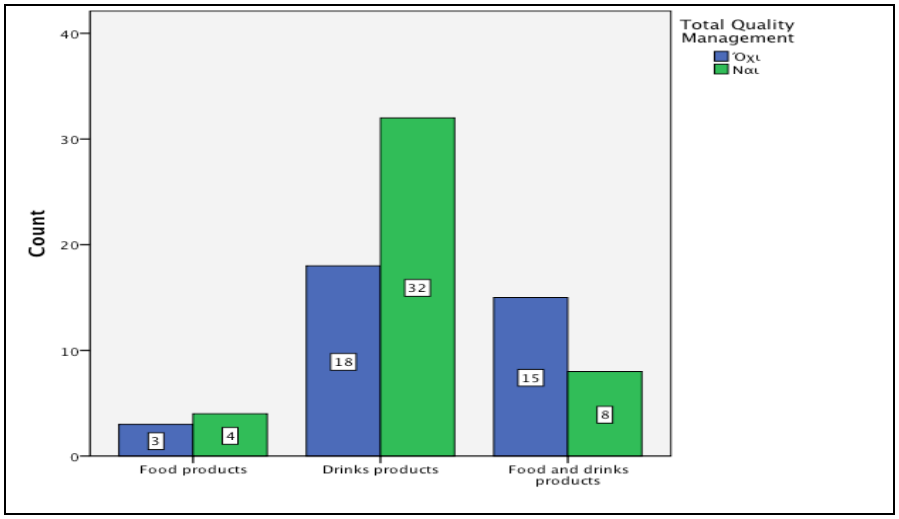

Fig. 2. Total Quality Management ISO HACCP

- Type of products / Management flow chart

Table 4 and figure 3 show the frequencies and percentages of companies that use a management flow chart in relation with the type of their products. Specifically, despite the type of the products, most of the companies do not use a management flow chart.

Table 4. Management flow chart

			Management flow chart		Total
			No	Yes	
Type	Food	Count	7	0	7
		%	100.0%	0.0%	100.0%
	Drinks	Count	47	3	50
		%	94.0%	6.0%	100.0%
	Food & Drinks	Count	20	3	23
		%	87.0%	13.0%	100.0%
Total		Count	74	6	80
		%	92.5%	7.5%	100.0%

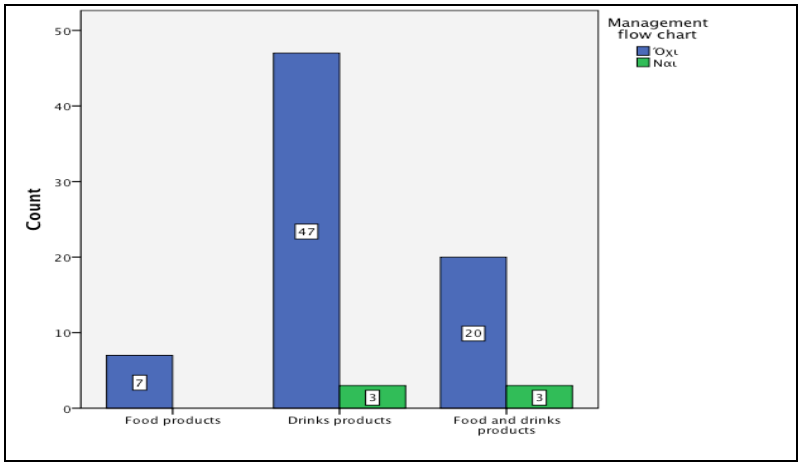

Fig. 3. Management flow chart

- Type of products/ Promotional activities

Table 5 and figure 4 present the frequencies and percentages of companies that use promotional activities in relation with the type of their products. Specifically, despite the type of the products, most of the companies do not use promotional activities.

Table 5. Type of products/ Promotional activities

			Promotional activities		Total
			No	Yes	
Type	Food	Count	5	2	7
		%	71.4%	28.6%	100.0%
	Drinks	Count	47	3	50
		%	94.0%	6.0%	100.0%
	Food & Drinks	Count	19	4	23
		%	82.6%	17.4%	100.0%
Total		Count	71	9	80
		%	88.8%	11.2%	100.0%

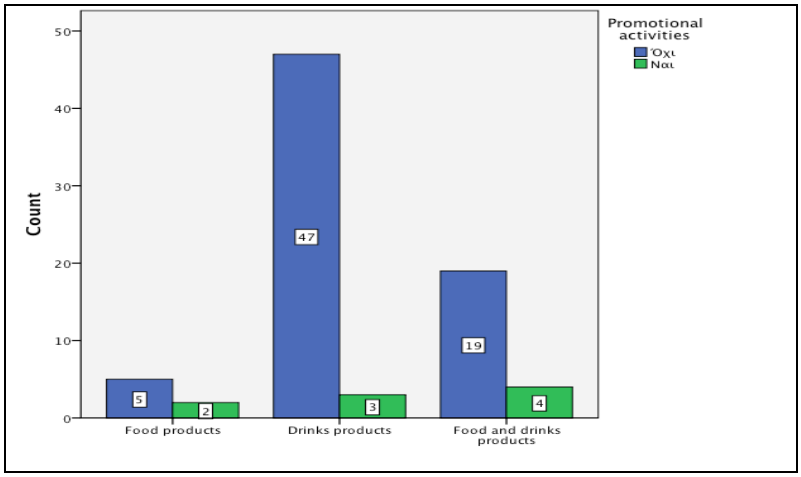

Fig. 4. Promotional activities

- Type of products / Social responsibility

Table 6 and figure 5 show the frequencies and percentages of companies that use social responsibility practices in relation with the type of their products. Specifically, most of the companies which sell drink products or a combination of drink and food products do not use social responsibility practices, while the bigger percentage of the companies who trade only food products have applied social responsibility practices.

Table 6. Type of products / Social responsibility

			Social responsibility		Total
			No	Yes	
Type	Food	Count	3	4	7
		%	42.9%	57.1%	100.0%
	Drinks	Count	35	15	50
		%	70.0%	30.0%	100.0%
	Food & Drinks	Count	15	8	23
		%	65.2%	34.8%	100.0%
Total		Count	53	27	80
		%	66.2%	33.8%	100.0%

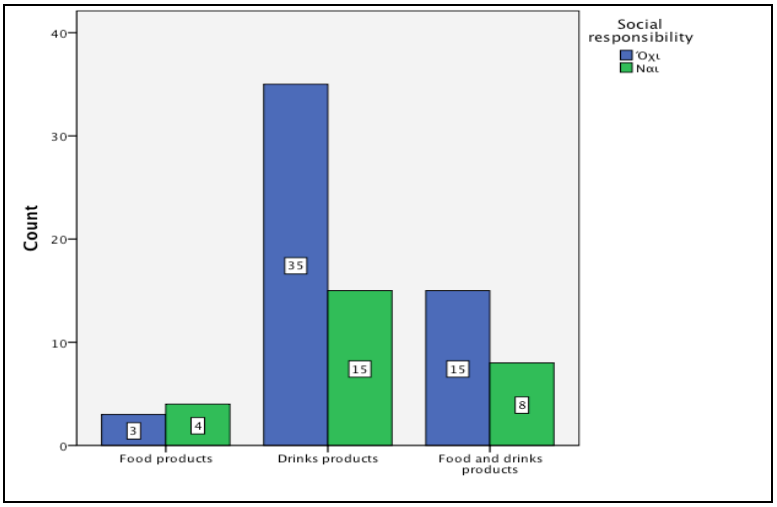

Fig. 5. Type of products / Social responsibility

- Type of products / Sales via the internet

Table 7 and figure 6 show the frequencies and percentages of companies that make sales via the internet in relation with the type of their products. Specifically, most of the companies which sell drink products or a combination of drink and food products do not make sales via the internet, while the bigger percentage of the companies who trade only food products have made sales via the internet.

Table 7. Type of products / Sales via the internet

			Sales via the internet		Total
			No	Yes	
Type	Food	Count	4	3	7
		%	57.1%	42.9%	100.0%
	Drinks	Count	37	13	50
		%	74.0%	26.0%	100.0%
	Food & Drinks	Count	17	6	23
		%	73.9%	26.1%	100.0%
Total		Count	58	22	80
		%	72.5%	27.5%	100.0%

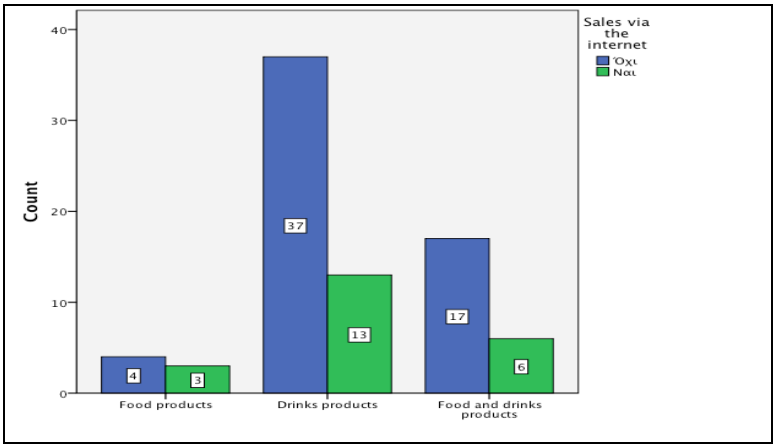

Fig. 6. Type of products / Sales via the internet

3 Conclusions

Taking into account all the above mentioned, most of the companies which sell drink products or a combination of drink and food products, do not use business and marketing plans, while the bigger percentage of the companies which trade only food products, have applied marketing or business plans. In addition, most of the companies which sell food or drink products do not use Total Quality Management practices, while the bigger percentage of the companies which trade both food and drink products have applied Total Quality Management practices.

Despite the type of the products, most of the companies do not use a management flow chart and also promotional activities. Moreover, most of the companies which sell drink products or a combination of drink and food products do not use social responsibility practices, while the bigger percentage of the companies which trade only food products, have applied social responsibility practices. Finally, most of the companies which sell drink products or a combination of drink and food products do not make sales via the internet, while the bigger percentage of the companies who trade only food products have made sales via the internet.

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Compliance of Food and Beverage Companies as to the Requirements of Internal Audit

Georgia Boskou[1], Efstathios Kirkos[2], Charalambos Spathis[3]

[1]Department of Accounting and Finance, Technological Educational Institute of Thessaloniki, Greece, e-mail: boskoug@acc.teithe.gr & Department of Economics, Division of Business Administration, Aristotle University of Thessaloniki, Greece, e-mail: mposkoug@econ.auth.gr
[2]Department of Accounting and Finance, Technological Educational Institute of Thessaloniki, Greece, e-mail: stkirk@acc.teithe.gr
[3]Department of Economics, Division of Business Administration, Aristotle University of Thessaloniki, Greece, e-mail: hspathis@econ.auth.gr

Abstract. This study assesses factors influencing Internal Audit Quality (IAQ) in Greece. Hand-collected data were obtained from 2013 and 2014 annual financial reports from companies such as food industries, beverage –and their subcategories- industries as well as fishing and distillation, listed in Athens Stock Exchange (ASE). Previous literature was chosen in order to highlight significant independent variables. Linear regression analysis examines the association between Internal Audit Compliance (IAC) and seven principal factors. In order to define IAC we consider the compliance of an internal audit function analyzing in operational aspects such as the Segmentation of Duties and the Professional Competence and Knowledge Adequacy. The results found indicate Internal Audit Compliance, on a sample of Greek listed firms; have significant associations between the degrees of compliance to some external audit variables.

Keywords: Internal Audit Compliance, External Audit, Corporate Governance, Food and Beverage Industry, Greece

Data Availability: All data are publicly available.

1 Introduction

Internal audit regulations have been the subject of an ongoing debate among academics, regulations, and practitioners, all over the world, and its effectiveness remains controversial in the aftermath of the recent financial crisis (Altamuro and Beatty 2010). One of the objectives of an internal control system is to provide reasonable assurance regarding the reliability of financial reporting (COSO 1992). The OECD (Organization for Economic Cooperation and Development) published the "Corporate Governance Principles" in 1999. The term "corporate governance" is used to define the way companies are governed and audited. Corporate governance as

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a concept and as a method of verification of transparency, the effective financial reporting and the way companies function, is considered as top priority for the investors in the money market from 1990s until today (Xanthakis, Tsipouri, Spanos, 2003). The high profile financial reporting scandals than marked the first decade of this century like: Enron, Worldcom, Parmalat, have highlighted the weaknesses management and control in business and especially in listed companies, provided evidence that the auditing practices may be enriched and improved (Kirkos et al, 2007a, Kirkos et al, 2007b) and led to revisions in internal control regulations globally. Different countries make different choices regarding the reporting of internal control in annual reports. Aglo-Saxon countries, along with the U.S.A have pioneered in this issue by legislating laws such as Cadbury, Sarbaness-Oxley (SOX). The European Commission (2006) has chosen the "comply-or-explain principle" with regard to corporate governance regulation, meaning the management either has to comply with the applicable internal control regulations of the member state or explain and report why they do not comply. The Greek Code of Corporate Governance (EKED) has been drawn up with the initiative of the Association of Corporations and Industries (SEB) and was modified afterwards in the framework of its first review by the Greek Council of Corporate Governance (ESED) on 28th June 2013. The Code aims at constant improvement of the Greek corporate institutional framework and the wider corporate environment, as well as to increase the investors' trust, not only to the total of the listed firms but also to each one of them separately, broadening at the same time the horizons of attracting entrepreneurial capitals. The Code is followed of the approach "comply-or explain" and demands from the listed firms that choose to implement it: to make known what specific intention of theirs and either to comply with the total of the special practices of the code or to explain the reasons for their non-compliance with the specific special practices (EKED, SEB 2013).

The purpose of this paper is to enhance the compliance of the companies, in the food and beverage sector, listed in ASE with the requirements of the Internal Audit, as defined by the Corporate Governance Code (CGC).

The rest of the paper is structured as follows:

- In Sect.2 the literature on IAQ is examined and specifically the literature on IAC.
- In Sect.3 a methodological notes describes the related indicators, the techniques and the regression model adopted in this study and the sample being considered.
- In Sect.4 results, in order to assess whether a relationship between the IA Compliance and the seven factors exists, in Food and Beverage companies and also presented directions for future research.

2 Literature Review

Law imposes the formation of an auditing committee on the listed firms. According to the optimum European practice, the Code recommends the formation of an auditing committee, which consists –in the majority- of independent non-executive members of the board. This recommendation improves the established order of corporate auditing of the listed firms in Greece, in which the dominance of big stockholders is obvious, as it enhances the feeling of safety of minority stockholders, imposing the independent supervision of the system and the internal auditing unit, including the auditing of financial informing. The listed companies are required –by law- to examine regularly their internal auditing system. What is defined as a system of internal auditing are all the procedures that are put in force by the Board, the Administration and the rest of the staff of a company, targeting at the ensuring of the effectiveness and the efficiency of the company tasks, the credibility of financial informing and the compliance with the applied laws and regulations (Kontogeorgis, 2013)

According to the model of Corporate Governance of Institute of Internal Audit (2005), the effective function of internal audit constitutes one of the basic pillars of corporate governance along with three others. Those three pillars are the control committee, the external auditor and company's administration. The significance of the internal audit can also be stressed by the fact that in many stock markets it is compulsory for the listed companies to run internal audit procedures. Especially now, following the latest corporate scandals that shocked U.S.A. it is compulsory for the companies not only to enact the function of internal audit but also to enact control committees within the company aiming at the most efficient function of the company (IIA, 2015). The Internal Audit Department (IAD) must adopt the following definition coming from the Institute of Internal Auditors and is accepted worldwide: "Internal audit is an independent, objective, ensuring and consulting activity, designed to add value and improve an organization's functions. It also assists the organization to achieve its professional goals by adopting a systematic, professional approach towards the evaluation and improvement of the efficiency of procedures of risk handling, of internal audit systems and corporate governance.

In 1992 the COSO committee sites a definition about internal audit that emphasizes the role of the administration during the control procedure. More specifically, according to COSO, "internal audit is a procedure which can be affected by the Company's Board, the Administration and the rest of the staff and is designed to provide sufficient reassurance" regarding the achievement of the following objectives:

- The effectiveness and efficiency of the functions
- The credibility of financial status
- The compliance with the applied laws and regulations (COSO, 1992)

One of the objectives of an Internal Audit (IA) system is to provide reasonable assurance regarding the reliability of financial reporting. IA quality is an issue of great significance to both internal and external audit professions. Additionally, the quality of the Internal Audit Function (IAF) will probably affect the assessment,

carried out by management and the external auditors, of the effectiveness of internal control over financial reporting that is now required by Auditing Standard No 2 (Gramling et al, 2006, Boskou and Spathis 2014). The public trust in an auditor's judgment is highly important in the process of accepting audit functions as valued-added services, that drive credibility to published financial statements (Rezaee 2004; Arena and Azzone, 2009). As a result it is important to examine which monitoring mechanism corporations can use in order to ensure the effectiveness of their internal control (Krishnan, 2005). Typical of the quality changes that the concept of internal audit has undergone, is the existence of a current trend that compels the internal auditor to comprehend and probe a number of issues of the company before he completes his briefing towards the Board. The new extended responsibilities of the internal auditor can be abbreviated with the letters GRC, which mean Governance, Risk and Compliance (GRC). An accepted and reliable definition of the GRC is that of "Open Compliance and Ethics Group" that was drawn up by a group of professionals relevant to internal audit. A summary of this definition refers to how an organization perceives the expectations of those interested in it, how activities are managed and run so as to maximize the performance of these expectations, handling risks, being at the same time in compliance with the applied laws, regulations and duties (Marks, 2010). In an attempt to study the relationship between internal control reporting and accruals quality in an alternative internal control regime based on the ''comply-or-explain principle'' in the Netherlands. They found that the noncompliance rate of providing a statement of effective internal controls is relatively high, and that companies give generic explanations for noncompliance or no explanation at all. In addition, they found that the noncompliance rate of providing a statement of effective internal controls is relatively high (Van de Poel and Vanstrelen, 2011).

A survey in Italian listed firms tried to find if there is an association between the compliances to codes and internal control effectiveness through IAF operational aspects. They conclude that there are significant associations between the degree of compliance to some corporate governance regulation and the Internal Audit Department (IAD) index for the sample being considered (Regoliosi and D'Eri, 2014). Mahdy and Park (2014) examine the association between disclosure of internal control deficiencies and information asymmetry in the US secondary loan market. Motivation for their research was the fact that legislation SOX 2002 requires firms to disclose the effectiveness of their Internal Control weaknesses as well as management evaluation of the effectiveness of controls and procedures (section 302) and external auditor's opinion (section 404).This research on Saudi Arabia public sector employs several measures of Internal Audit Effectiveness (IAE), implement internal audit recommendations. The findings depict an association between management support and more effective internal audits and the necessity for implementation and compliance internal audit recommendations (Alzeban and Gwilliam, 2014).

Food and Drink Industry –even in financial crisis times- retains its fundamental role in Greek Economy and in Greek processing industry and has the potential to remain the basic force of the country's development. These industries constitute an important factor of Greek Economy, because they are supplied with raw materials from the agricultural sector and because they provide consumers with basic daily

goods (Mattas and Tsakiridou, 2010, Chatzipetrou and Moschidis, 2015). Issues that come up regarding the role of domestic food and drink industry as a vaulting bar for growth and development have to do with the extroversion and exporting, the equality of Greek products, the identity of the products and the organized promotion of Greek food products. The effective coordination and the close cooperation of the representatives of this sector can contribute to the improvement of the efficiency and effectiveness of the promotion of the Greek products, to the ensuring of choosing the proper strategy and to the stability of the realization of this long-term planning. The creation of additional value and the enhancing of the extroversion of the profession are up to –a great extent- to the promotion of the Greek product, to its relation with the third primary sector of tourism but also to the perspective that the profession presents on the financial elements revealed at the annual reports, adding value to it (Antoniadis, 2004, Report, IOBE 2013).

Against this background, the following hypothesis is formulated:

H1. *In a comply-or-explain regime, there is an association between Internal Audit Compliance (IAC) and external auditors report.*

3 Methodology

3.1 Sample size and selection

Studies of internal audit quality are few in number compared to studies of external audits. This research investigates factors that may influence IAQ within food and beverage companies listed in ASE during the crisis period and especially years 2013 and 2014.

Specifically the sample consists of Food and Beverage industries and their subcategories as well, fisheries and distillation. This gives us 23 firms on an annual basis observation. Further we exclude 2 firms, one that its data was not available as it was on suspension (Dias SA) and the other because its twelve-month use does not coincide with the calendar year (1/1-31/12) but with the taxable year (1/7-30/6) (Hellenic Sugar Industry SA). This yields a final sample of 44 firms examined over a period of two years (Appendix A). We retrieve financial data and data relevant to the function of Internal Audit taken from the annual reports. Data on the internal audit requirements and rations were hand collected and manually coded from the annual reports of the companies.

3.2 Research models

We use multiple linear regression analysis to examine the association between IAC and external auditors report. The *dependent* variable in this study is Internal Audit Compliance (IAC) which is a complex variable resulting from the i) Segmentation of Duties and the Professional Competence and knowledge Adequacy

ii) Regulation Levels of Approval iii) Authorization of Access to files on the financial statements.

The factors were identified from a review of previous academic literature studying the internal audit function. Guidance from International Professional Practices Framework (IPPF) and other related documentation is also considered. These choices identified seven factors as relevant to IAC: Opinion with paragraph, number of paragraphs, audit company code, return of assets (ROA), return of equity (ROE), leverage, company size.

We use external auditors' opinion, as *independent* variables, to evaluate IAC on:

1. Whether the external auditors' report contains remarks (with paragraph) in the external auditor's evaluation report. (An indicator variable equals 1 if the auditor's report contains remarks, otherwise it equals 0).
2. The number of issues external auditors' reports refers to. (An indicator equals to the total of the remarks).
3. Whether the auditing company belongs to Big.4 or not. (An indicator variable equals 1 if the audit company belongs to Big 4, otherwise it equals 0).

In order to ensure that we could isolate the factors that are associated only with high degree of compliance and that they do not belong to the external audit variables mentioned previously, it was important to include additional control variables which have been identified by previous literature as being significant ones in the analysis. For example, we examine specific firm characteristics like ROA, ROE, Leverage and Company Size:

- Return of Assets (net income/average total assets, Mahdy and Park, 2014).
- Return of Equity (net income/average equity).
- Leverage measured at year end 2013 and 2014: LEVERAGE (as measured in terms of Average Assets and Equity).
- Company size as of 31.12.2013 & 31.12.2014: SIZE (as measured in terms of the natural logarithm of total assets Klein 2002, Regoliosi and D'Eri 2012).

3.3 Empirical results

Descriptive statistics

Table 1 shows the mean and the std. deviation.

Table 1. Descriptive Statistics of All Variables

Panel A: Full Sample (n=44)		
Variable	**Mean**	**Std. Deviation**
IAC	0.91	1.427
Opinion with paragraph	0.41	0.498
Number of paragraphs	1.22	1.725
Audit company code	0.15	0.363
ROA	-0.05	0.117
ROE	-0.07	2.307
Leverage	-2.30	47.356
Size	7.66	1.242

Correlations

Table 2 present Pearson correlations between the transformed dependent and independent variables. The following correlations support several theoretical hypotheses: *IAC* is significantly positively correlated with *Number of* paragraphs. Table 2 also shows that many explanatory variables are significantly correlated with each other. The test of the formal hypothesis is based on linear regression analysis.

Table 2. Pearson Correlation Coefficients between the Variables

Variable	***IAC***	***Opinion with paragraph***	***Number of paragraphs***	***Audit company code***	***ROA***	***ROE***	***Leverage***	***Size***
IAC	1							
Opinion with paragraph	0.239	1						
Number of paragraphs	0.369*	0.851**	1					
Audit company code	0.069	0.136	-0.019	1				
ROA	0.052	-0.579**	-0.547**	-0.207	1			
ROE	0.001	-0.016	-0.072	0.018	-0.179	1		
Leverage	-0.219	-0.107	-0.115	0.043	0.022	-0.871**	1	
Size	0.213	0.203	0.180	0.215	-0.274	0.050	0.037	1

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Table 3 shows the *Adjusted* R^2 is 0.209 which is satisfactory.

Table 3. Regression Model Summary

	Adjusted	**ANOVA**[a]	
	R Square	F	Sig
Regression	0.209	2.545	0.032[b]

a. Dependent Variable: IAC

b. Predictors: (Constant), Opinion with paragraph, Number of paragraphs, Audit company code, ROA, ROE, Leverage, Size.

Table 4 presents the empirical results. Significant variable is *Number of paragraphs*. As far as control variables are concerned, we can see that IAC is significant positive associated with *Size* and *ROA*.

Table 4. Regression Coefficients[a]

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	-8.350	4.138		-2.018	0.052
Opinion with paragraph	-0.707	0.782	-0.250	-0.905	0.372
Number of paragraphs	0.599	0.257	0.714	2.328	0.026
Audit company code	0.180	0.621	0.048	0.289	0.774
ROA	4.938	2.149	0.425	2.298	0.028
ROE	-0.113	0.189	-0.189	-0.599	0.553
Leverage	-0.023	0.021	-0.352	-1.061	0.296
Size	1.161	0.537	0.360	2.160	0.038

a. Dependent Variable: IAC

b. Predictors: (Constant), Opinion with paragraph, Number of paragraphs, Audit company code, ROA, ROE, Leverage, Size.

4 Conclusions

The purpose of this study is to provide insights into the internal control quality, the compliance with the internal audit regulation and the relation with the external audit. In particular, we investigate the relation between compliance with the internal audit regulations as they depict on the annual reports and the present interaction with the indicators of external audit.

We conduct our study in Greece and specifically on food and beverage companies, which are listed in ASE for the following reasons. Firstly, a corporate governance code is applied in Greece, in particular the "comply-or-explain" regime which by its structure it contains important information on the internal audit system and its application. Secondly, we wished to view the correlation between internal audit quality and the external audit opinion. Last but not least, the specific sector of food and beverage industry is particularly important in our country due to its relation both to the primary and the tertiary sector of production, especially in these two years during the elation of the economic crisis, examined in our sample.

The results found indicate that internal audit compliance, the dependent variable, is a complexion of: 1) the segmentation of duties and 2) professional competence and knowledge adequacy and is related to a great extent with one of the three independent variables, that is "number with paragraph" which refers to the number of issues that the external auditor puts stress on without on the other hand his positive view to be influenced in the external audit report. There is also a high degree of correlation with the two of the four control variables, such as "SIZE", which refers to the company's size, and "ROA", which is an indicator of how profitable a company is relative to its total assets.

Although considerable attention was given to the method and the design of this paper, some *limitations* still exist. Firstly, in order to be able to conduct the comprehensive literature review, the focus was kept relatively narrow in IAQ. Also, we found only 23 companies for the year 2013 and 21 for the year 2014 listed in ASE that are part of the food-beverage sector due to the economic crisis that our country has been facing for the last five years, many companies have been on suspension regime. Secondly, the existing literature studying the relation between IAQ and IAC is rather restricted, due to the fact that reports in IA departments are not publicly available. Results provided by this research cannot be regarded as generally applicable, although this study should contribute to the development of a deeper understanding of the characteristics of Internal Audit Quality.

The suggestions formed after the completion of this present research paper on *future research* could be as follows:

1. Extension of research to other sectors of Athens Stock Exchange in order to broaden our knowledge on the quality of internal audit on more sectors of ASE.
2. The correlation of internal audit quality with financial sizes. This investigation will provide the possible existence of relations between the internal audit quality and the financial sizes of a company.

3. Wider evaluation of the compliance with internal audit models or with corporate governance codes on the part that refers to the known object of internal audit.
4. The correlation of internal audit quality with the external audit and the interaction between them.
5. Focusing analysis on the specific components of the IA indicator or create other IA total indicators and attempting to assess the contribution of several CG elements to other aspects of IAQ.

The contribution of internal audit quality has greatly increased nowadays due to the hard economic conditions that our country faces. Internal audit can resolutely contribute to the improvement of competitiveness of Greek company, specifically in food and beverage sector and by extension to Greek Economy. This improvement can constitute a major factor so as Greece exits the economic crisis.

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Appendix A

Industry Segment	Companies
Refreshments	Coca Cola AE
Distillation & Wine Production	Boutari SA
	Constantin Lazarides SA
Agriculture & Fishing	Dias SA
	Galaxidi Marine Farm SA
	Hellenic Fishfarming SA
	Nireus SA
	Kreka SA
	Selonda SA
Food	Creta Farm SA
	Elgeka SA
	Evrofarma SA
	Hellenic Sugar Industry SA
	K.Sarantopoulos SA
	Karamolegos SA
	Kepenos Flour Mills SA
	Kri-Kri SA
	Kriton Artos SA
	Loulis Mills SA
	Nikas SA
	Perseusgroup SA
	Sons E.Xatzikraniotis Flour Indusrty SA
	SteliosKanakis SA

Marketing Strategies of Large Agricultural Holdings and Social Commerce: the Case of Terra Orti PO

Irene Paola Borrelli[1]

[1]Simone Cesaretti Foundation, Italy, e-mail: irenepaolaborrelli@gmail.com

Abstract. Generally, the advantages of short food supply chains are associated only to small agricultural holdings and/or farms with a limited production output, but not to larger agricultural holdings. These considerations are limited. For larger producers these forms of marketing could transform from being a mere instrument of commercial diversification into a promotion instrument that makes it possible to translate the acknowledged or desired values in products in the short supply chain to the entire commercial output. The paper, following analysis of the characteristics of e-commerce in agribusiness, proposes the experiences of the Terra Orti Producers Organisation in implementing social commerce for promoting fruit and vegetable products from the "Piana del Sele" territory.

Keywords: social commerce, e-commerce, Producers Organisation, short food supply chains, Campania Region.

1 Introduction

Interest in the development of short food supply chains is increasingly greater. Agricultural holdings are particularly attracted by this form of marketing for two opportunities: obtaining a "higher added value", by reducing intermediation costs or trimming a higher price compared to methods by traditional channels, and capturing new niches in the market, thereby meeting the specific customer needs in terms of quality and/or the services required (Fabbrizi et al., 2014; Bazzani and Canavari, 2013; Di Trapani et al., 2013).

Generally, these considerations are valid for small agricultural holdings and/or farms with a limited production output, but for larger agricultural holdings their validity is somewhat relative. Indeed, for larger businesses, a belief that utilising a short food supply chain can provide a unique response to their commercial needs is arguably a short-sighted or utopian view.

The objective of this paper is to give a new understanding of these forms of marketing, forms which are also useful for larger producers.

The aim is to transform the short food supply chain from being a mere instrument of commercial diversification into a promotion instrument that makes it possible to translate the acknowledged or desired values in products in the short food supply chain to the entire commercial output. This will enable large agricultural holdings to:

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- harness a new section of demand with which to construct a relationship of trust that may influence consumer choices in different purchasing situations and places;
- possess a more immediate knowledge of new trends in demand with the advantage of being able to improve their commercial output and anticipate the demands of the traditional channels.

The paper, developed as part of the "New Orto Chain" project funded by the Campania Region, following analysis of the characteristics of e-commerce in agribusiness, proposes the experiences of the Terra Orti Producers Organisation in implementing social commerce for promoting fruit and vegetable products from the "Piana del Sele" territory.

2 E-commerce and Agribusiness: a Question of Trust

In general, it may be asserted that commerce that is supported by the Internet offers considerable opportunities for businesses. Businesses can expand their customer base and enter new markets, going beyond their immediate geographical vicinity (Cesaretti et al., 2006). Unfortunately, the potential of this tool is underused. There are in fact few businesses that recognise the strategic value of the Internet for their competitiveness (Misso, 2013).

This is of even greater relevance in the agri-food sector, the particular features of which are slowing down the spread of e-commerce within the sector as a whole.

Cultural factors and concerns of food health and safety constitute major obstacles to the dissemination of the use of ICT and Internet tools (Misso et al., 2013). Added to this is the high degree of product differentiation, both in terms of specific sensory qualities, and respect for qualitative parameters, which leads to considerable difficulty in formulating effective e-commerce communication (Canavari *et al*., 2009).

One of the most significant barriers to the introduction and use of e-commerce in the sector is trust, which is an essential element during the purchasing process, and is not being communicated and conveyed appropriately by existing e-commerce tools (Cubico *et al*., 2006).

For the purchases of agri-food products, trust already plays an important role, and it is amplified even more in Internet negotiations. Indeed, with these purchasing methods, the sense of trust is considered the variable that should be focused on in order to overcome the consumer's perception of risk in these purchasing methods, associated with the fear of passing on personal information such as credit card details, and the problem of making purchases without being able to actually touch the items (Bhatnagar et al., 2000).

Being able to build a relationship of trust in e-commerce is different from the process of a face-to-face business transaction with the seller. For these purchasing situations, the consumer can rely on ancillary information such as non-verbal expressions, the seller's expertise, empathy, and emotions. All of these are elements that can help facilitate confidence and reduce the perception of risk, without forgetting that the dynamic nature of the relationship can provide greater

opportunities in offering an immediate response to the consumer's concerns (Bazzani and Canavari, 2013; Giuca, 2012).

It is therefore necessary to question how overcoming these problems is essential in devising strategies that can facilitate virtuous processes that ensure consumer confidence.

In designing an e-commerce platform, one limitation is not being able to manage an adequate information flow that can suitably communicate the high levels of quality or differentiation.

There can be many fields of operation, which are summarised by Lee and Turban (2001) in three areas:

- credibility in the website and its information;
- reliability identified with the online channel;
- a relationship of trust understood as a form of individual tendencies in terms of trust in relationships with others.

The business can act independently on matters of credibility and reliability, but for a relationship of trust - a distinctly cultural and personal element - it must work to make the consumer central.

In this sense, support may be provided by leading online tools such as social networks, blogs, wikis, etc. that offer the chance to create an interaction with visitors and users. More specifically, with these applications, users can foster networks of relationships with their peers based on shared interests, values and identities (Finotto & Micelli, 2010; Simmons, 2008; Cova, 1997).

3 Web 2.0 from e-Commerce to Social Commerce

We must therefore imagine how to move from the mere publication of information to creating virtual places in which everyone can contribute. A way of doing so is by encouraging participation: the user moves from being a passive subject to the protagonist of content creation.

In other terms, with web 2.0 we are witnessing the transformation of the internet from a space of information to a space of participation. These tools are helping to change the nature of consumption radically, improving customer participation, promoting relationships between customers, and creating, inter alia, a greater economic value (Kim and Srivastava, 2007; Liang *et al*. 2011; Parise and Guinan 2008). This development of electronic commerce is commonly identified with social commerce.

Modern web applications are having a significant effect on business transactions, reliability and reputation (Swamynathan et al. 2008).

Social commerce is the new frontier of e-commerce, is overcoming the isolation of the consumer who, through social networking, is taking part in a rich social life which inevitably has an impact on their perceptions and purchasing processes (Finotto & Micelli, 2010).

The development of an e-commerce platform into social commerce requires new guidelines for its design. Based on the model of Fisher (2010), Huang and Benyoucef (2012) have identified four levels of intervention: individual, conversation,

community and commerce. These elements are all interrelated, and the absence of just one of them may result in not being able to trigger the benefits of the synergies between e-commerce and virtual community.

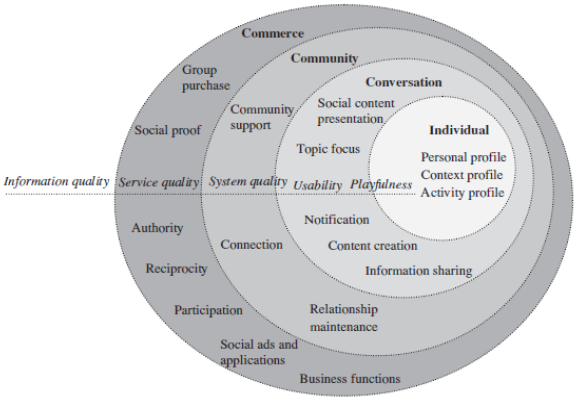

Fig. 1. Social Commerce design model by Huang and Benyoucef (2012)

Under the approach proposed by these authors, everything should be centred on the individual. Everyone should make their contribution to the community but their individuality should be preserved and appreciated. The second step is conversation, or participating in the exchange of ideas and information. Without these interactions, there is no proliferation of user-generated content and no sharing of knowledge. Conversations, in the case of social commerce, are the expression of the relationships that cement and create the virtual community. Finally, the broader level of design involves Commerce and is aimed at implementing the needs of the created community and online business services.

Being able to implement social commerce can provide not only a better and easier access to your business with greater brand awareness, but can also play a strategic role in future development. Through certain applications, in fact, the business can get some indication on how to improve or innovate their commercial products. Moreover, the ongoing relationships in the community can be used to facilitate after-sales service, by delegating part of the support activities to the users themselves.

In parallel, the business that is starting out with these experiences should be aware that these applications require a substantial transfer of its own communication processes to figures that are not controlled: there will be loyal and enthusiastic customers, but also critics and opponents (Finotto & Micelli, 2010). In order to limit the risks of negative consequences in terms of credibility and image, it is crucial to be able to rely on professionals who known how to manage the information as efficiently as possible and can stimulate user participation.

4 Designing Social Commerce for the Promotion of Piana del Sele Agri-food Products

In 2013, through provision of the measure 124 of the 2007-2013 Rural Development Programme, the Campania Region funded the "New Orto Chain" project, which was aimed at testing organisational models for developing new forms of marketing and communication in short channels that could meet the dual objective of ensuring competitive development of the fruit and vegetable sector and reference territories.

Research institutions such as the Parthenope University of Naples and the Simone Cesaretti Foundation, along with production and marketing businesses in the fruit and vegetables sector such as the agricultural business Morella, the agricultural company F.lli Esposito and the Terra Orti Producers Organisation were involved in bringing about this project.

In particular, in this programme reflections are proposed on the big business - short supply chain approach in relation to the implementation of online sales.

The leading group in this activity is Terra Orti, one of the most successful Producers Organisations in the Campania Region, operating in the “Piana del Sele” area.

In 2014, their turnover exceeded 50 million Euros, and production volumes surpassed 520,000 tons. An analysis of the turnover for the year 2014 shows that 84% comes from domestic sales, 15% from EEC countries and 1% from countries outside the EEC, thanks to the presence of Swiss customers. As far as the domestic market is concerned, there are around 350 clients and the primary marketing channels are the general markets, that contribute 49% to the turnover, while other intermediaries comprise 45%. A secondary but nonetheless import contributor is large-scale retail with 5%. From the analysis of the general market channels and "other intermediaries", it emerged that the main production destination is the north of Italy. If we consider that the general markets are the main form of supply for retailers, we can affirm that in 2014, only 5% of the total production was consumed in the reference area of the Terra Orti.

These figures clearly show the prevalence - or indeed the exclusivity - of the traditional channels and, therefore, a reduced opportunity of having a direct contact with consumers. There is clearly a gap between the world of production and the world of consumers, a strong contrast in the consumers' need to want to know more not only about what they are eating but about who is producing it.

All of this is at the heart of the Producers Organisation's interest in alternative forms of marketing, such as the short food supply chain.

In this context, the Producers Organisation has been investing in direct sales channels in recent years. They have opened sales outlets, initiated box-schemes activities for urban areas in the region. participated in fairs and markets, and organised informative meetings and cultural events. These activities are not highly profitable but allow the business to earn the trust of their customers, involving direction, information and sponsorship of their brand, of their products and their particular business culture.

Their presence on social networks is also very significant, the Facebook page of the Producers Organisation numbers more than 2,000 users.

The last method of direct selling that it was decided to experiment with is e-commerce. In the case of e-commerce, the working group decided not to stop implementation of the classic e-commerce platform but to design a social commerce to promote the value of agri-food products from the Piana del Sele territory.

In the spirit of social commerce, a communication strategy was established that would surpass commercial supply and include broader thematic analyses that could involve interests on the basis of which users could meet with one another.

The basic idea is to create and stimulate a virtual community that can share the experiences and gastronomic culture of the region. In other words, the intention is to recreate the distinctive features of the short food supply chain online; the spirit of the initiative is "everywhere with you".

Starting from this assumption, it was not just a simple product catalogue that was constructed but a whole territorial supply based around it.

The choice of information to be included was influenced by the many meanings associated with the product acquired in the short food supply chain, summarised in the following table (Brunori, 2007; Goodman & Goodman, 2009).

Table 1. Meanings associated with the product of the short food supply chain.

Attribute	Meanings
Functional	healthiness, taste, freshness and seasonality of the product
Ecological	Food miles, the reduction of packaging, preservation of natural resources involved and the preservation of biodiversity
Territorial	product's ability to reproduce the diversity of its terroir
Cultural	enogastronimic culture, territorial identity
Ethical	fairness and corporate social responsibility
Political	relationship in the supply chain, re-orientation of the paradigms of production and consumption

More specifically, the aim was to attract the consumer community to become more aware about purchasing not just a product, but a small piece of the region. For each product, an information sheet was created that would meet all the features. Below is an outline summary of the content offered by the various attributes.

Table 2. Summary of the content offered by the various attributes for each product in the e-business platform.

Attribute	Content for each product in the e-business platform
Functional	Properties and benefits closely related to health
Ecological	Character merchandise in terms of biodiversity protection;
Territorial	Land cultivation; customs and traditions
Cultural	History and rarity
Ethical	Enhancement of producers with geolocation
Political	Economics and production methods

For the "social" aspects, the platform provides for the complete interaction with the social network Facebook. In the product list, it is possible to consult feedback from users who have purchased it and for uses to post their comments about the product.

All that has been described thus far does not provide an answer to the broader mission of a social commerce, or, to stimulating the community on issues of interest.

On this particular aspect, the working group had to choose a common denominator for the community. There were many alternatives to those most commonly used in nutritional education, healthy food, or even, particular dietary habits. Along with the Producers Organisations, it was decided to develop the subject of food understood not as something to be consumed, but as an expression of traditions and culture. The proliferation of television programmes, specialised magazines, and websites shows how interest in these issues is increasingly widespread and involves a broad target market.

In this regard, the platform will give ample space for prospective web-chefs to share culinary experiences. Recipes from culinary tradition in the Campania region using Producers Organisation products will be suggested, and users will be invited to express their opinion and to post their reviews. All this is aimed at encouraging the consumer to transform the traditional product into a gastronomical innovation.

For content development, a collaboration was established with the Higher Hotel School in the municipality in which the Terra Orti Producers Organisation is based. This aspect has a double positive value, both for the authority of the content offered to the virtual community, and in terms of the relationship of the Producers Organisation with local stakeholders.

In addition to the recipes, students are organising short video suggestions with their school that reveal some tricks of their trade. This activity aims to be of service to aspiring web-chefs but also aims at expanding the community, by attracting interest from the network of friends of the students involved.

Initially, in order to encourage user participation, a competition was launched to find the best recipe. The winner received a basket of Producers Organisation products and a discount voucher for online purchases.

Another important aspect in facilitating information retrieval is the navigation menu. It was considered important to offer the user different options in order to meet specific needs:

- *Recipes*: providing a further breakdown of information, this method will be chosen primarily by the community member who has an interest in the information
- *Products*: providing a sub-menu showing the product category (jams, preserves, marinated vegetables, etc.), consumers who have already purchased a product and want to do so again, and consumers who already have the product but want more information on how to use it, will choose this method.

For the original purposes of enhancing the product offerings from Piana del Sele, it should be stressed that creating web pages involves providing more and more information about the region. In other words, research into traditional or innovative

dishes and/or the products on offer by Terra Orti will be supplemented by a discovery of the Piana del Sele territory.

5 Conclusion

The platform has not been available online long enough to be able to make assessments on the outcome of the results. One very interesting aspect relates more to the producers than the users or consumers. The initiative has generated interest in the majority of Producers Organisation members, both small and large producers. Their need for recognition has been answered, and the anonymity that originates from traditional channels has been overcome.

The first positive responses have been established in terms of creating a virtual community. The followers of the Producers Organisation facebook page have responded promptly to requests to share a link to the platform on their profile.

In addition, the majority of the virtual "friends" have accessed the platform and some have started to breathe life into the community with their comments.

There is a further interesting feature about the first active users: they are people with origins in Campania but who live outside the region. It is a sign that their sensitivity to the specifics of their region is strongly pronounced and the desire to strengthen their roots serves as a strong incentive to participate.

From an operational perspective, the need to devote more resources to managing the "conversations" was revealed. In order for social commerce to work as effectively as possible, expertise is required that is both technical in order to deal with the commercial output, but also relational in ensuring the constant stimulation of interaction among the different users.

With this initiative, the Terra Orti Producers Organisation does not only target economic results, as highlighted above, although managing to earn revenue that could help with its management would be important, but it also aims at triggering a promotion tool for the entire commercial output through social commerce.

All of this provides evidence of the benefits that large fruit and vegetable businesses can reap by investing in short supply chain marketing. They are benefits that manifest themselves not in monetary terms, but in terms of the relationship of trust that is established with the end consumer.

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The Influence of Advertisement in Fresh Milk Consumers' Behavior

Ioannis Papaioannou[1], Irene Tzimitra – Kalogianni[2], Eleni Tegkelidou[3]

[1]Agronomist MSc Agricultural Economics, Aristotle University of Thessaloniki, Greece, e-mail: iopapaio73@gmail.com
[2]Professor, Department of Agricultural Economics, Aristotle University of Thessaloniki, Greece, e-mail: tzim@agro.auth.gr
[3]Manager-Vocational Trainer, Greece, e-mail: elenateg@mycosmos.gr

Abstract. Since prehistoric times milk has always been a basic element of man's nutrition. It is the simplest, most complete and natural food because it contains ingredients, like fat and lactose, which give energy, proteins and minerals to the human body and contribute to its construction. Consumers usually ignore the simple truths about the great value of milk as food. This lack of information must be covered by advertisement, due to what is called advertisement, of a product since it is a consumer's mass information for all the special features of a product, in order to convince them to buy it. From the results accrued, in the qualitative research in urban Thessaloniki, useful conclusions were drawn, which were used for the questionnaire's compilation and the conduct of the quantity issue.

Keywords: Advertisement, consumer's behavior, fresh milk – qualitative research.

1 Introduction

Since prehistoric times milk has always been a basic element of man's nutrition, from the first stages of life to later on. It is the most simple, fulfilled and natural food, because it contains ingredients, like fat and lactose, which give in human body energy, proteins and minerals, which contribute in its construction and also consists of enough vitamins quantity and micronutrients for the accomplishment of the necessary biochemical work (Kondili et al, 2014). Although, milk since infancy is not the only human's food, it still plays a significant role in youngsters diet, in addition to dairy products, contributes seriously in human body's supply in nutritional ingredients necessary for its growth. It also, constitutes of an important element of balanced diet in adults not only it contains all the essential nutritional ingredients, but also is rich in all the elements, which are necessary for adults' nutrition. Without milk, the ensuring of those ingredients in human body it would be difficult if not impossible. For example, milk when it is combined in planted foods creates a balanced diet.

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Today is known that milk, besides the fact that it is an excellent food foe all ages, it also has some additional beneficial qualities. For the growth and health of human body, which cannot be explained even in the most strict scientific criteria. Consumers usually ignore the simple truths of the great value of milk as food. This is due to great differences which are observed in milk's consumption between countries, which are not due to consumer's habits or market's organization, but mainly in insufficient information for milk's excellent nutritional effects (Mantis, 2006, p. 177). This lack of information is due to be covered by advertisement, because the advert of a product is the mass information of consumers for all the special characteristics of goods, in order to convince consumers to buy it (Kitsopanidis et al, 2003, p. 482).

Advertisement plays an important role in the promotion of any product and product information provided through advertisement also plays vital role in changing consumer attitude towards advertisement and their purchasing behaviour (Usman, et al., 2010). Our way of life and values are strongly influenced by mass media like TV, newspaper, radio and the internet and it has the ability to shape viewer taste and trends (Rachana Kejriwal & Dr. Dipti Kumar Chakravorty, 2014).

Nowadays e-advertisement becomes a successful way to promote agro-food products (Tsekouropoulos et al, 2012). Moreover internet is very widespread in all agro food sectors and has been extremely important tool for the promotion of business sales (Andreopoulou et al, 2013; Andreopoulou et al, 2012). In Greece, many enterprises in the agro-food and drink sectors are already present on the internet (Tsekouropoulos et al, 2013). Online advertisement service covers all aspects of driving quality traffic to a website and uses a diverse range of tools (Vlachopoulou, 2007).

As a research area the urban of Thessaloniki was picked for two main reasons: First of all, as far as population is concerned, it is a very dynamic complex will continually growing tends, which will give in research safe and valuable results as possible, due to urban features There are many market resources and fresh market consumption for all citizens who show obvious interest in this product.

2 Objective Points in Research

The main objective points of the research are the following:

a) To investigate the relation between the socioeconomic features of consumers towards their preferences to fresh milk.
b) To clear the basic characteristic – criteria of fresh milk, which affect the demand.
c) To investigate the effect of advertisement in fresh milk consumer's behavior.

3 The Concept of Consumer's Behavior

Magnisalis (1997) determines the meaning of consumer's behavior as the behavior formed by a group or a person, in market situation which can be observed or reported. The knowledge of consumer's behavior, apart from a study and research in Marketing, constitutes the basic condition for successful function of all the businesses which operate in market and are related directly to customers (Tsekouropoulos, 2009). The effort to fulfill consumers is achieved only if its behavior is known (Tzimitra, 1991). However, this knowledge is based mostly in facts than hypothesis or speculations. Studying consumer's behavior is not far from studying man's behavior in total (Georgtzakis 1996, p. 56). The position of consumer is essentially estimations or assessments, which express the possibility or several brands to satisfy specific needs (Tsekouropoulos et al, 2014). So, consumer's needs affect its position and these in turn, affect its purchases (Well and Prensky).

Consumers decide about the choice, purchase and usage of products and services. The above choices are often hard. Consumers face a huge alternative number of choices, because of the rapidly growing of technology (Kotler et al, 1996). Also, as far as purchase is concerned, many times face the trade's diversity (Robertson 1991).

Specifically, with the term "consumer" meaning the person and groups who uses products and services to face a variety of needs connected to their birth and psycho. Basic element in study and research for many scientists dealing with marketing is the consumer and its behavior towards any kind of human manner purchase and usage of products and services (Magnisalis 1997).

4 The Meaning of Advertisement - The Meaning of Fresh Milk

Advert of a product is called massive information of general public for products specific characteristics, in order to be purchased to buy. The American Market company defines advert as following. Advert is called each paid form of impersonal presentation and ideas promotion goods and services from a specific sponsor, person or agency.

Form the above definition is presumed that the basic role of advertisement is practically double:

a) Informative, since it informs consumer for the special characteristics of the product.
b) Convinsing, because it tries to convince consumer to buy the advertised product (Kitsopanidis et al, 2003, p. 483).

Advertisers had their largest profits from knowledge of previous purchases of consumer and also the loyalty of consumer to any product plays another important role in leading consumer attitude to purchase of that product (Mohammed, et al., 2012).

Milk, has got a special place among other animal and vegetable food because is exclusively food for man but for mammals as well, for the first stage of life. Contrary to the other mammals, who uses their mother's milk to satisfy their nutritional needs

just for few days or for months after birth, man uses milk of other mammals in every stage of life (Zarmpoutis 1994, p. 123).

The milk contains all nutritional ingredients that needs a human body to grow, especially adequacy of proteins and salt. Although after its infancy, milk stops to be the only food to human, however it continues to play a significant role in youngster's diet with the rest diary products, because it contributes especially in body's supply in nutrient necessary to its growth. Also, it is an important fact in adults balanced diet and not only because of it essentially nutritional facts, but also because it is rich in all elements, which are important in adults dieting. In its diet, man uses cow's milk, sheep's, and goat's. Consumers usually ignore the simple truths in great nutritional value of milk mostly because of lack of information for is excellent nutritional qualities (Mantis 2006, p. 151).

5 Methodology of Research

The accomplishment of research imposed not only usage of primary but also secondary data source and varied gathering techniques. Firstly, a literature review took place related in issues with consumer's behavior, the meaning of advertisement, fresh milk as relevant studies with this under investigation issue. Subsequently, there was quality research. In this situation, quality research is followed as methodology and as an investigation method the focused group interview were picked. The quality research took place in May 2012 in urban Thessaloniki. The total number of consumer focus groups who were studied was five each group consisted of six people. In total, in this quality research thirty consumers took part. As for their social and financial characteristics of consumers, fourteen were men and sixteen were women, as their age is shown in figure 1.

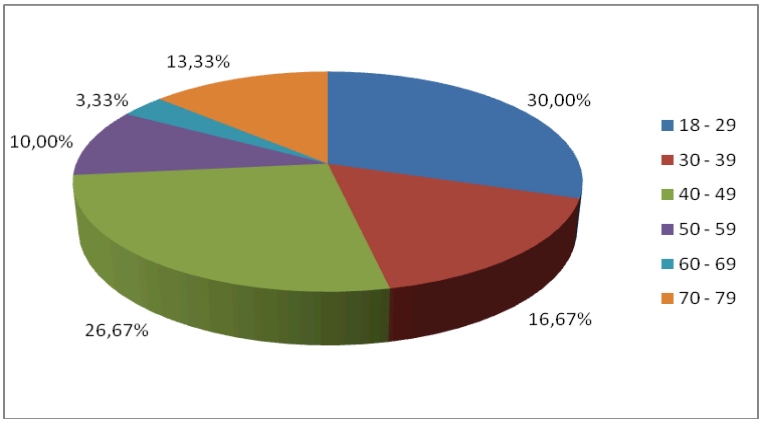

Fig. 1. Consumers' age

Most of them taking part were between eighteen to twenty nine years old (30%), while fewer were sixty to sixty nine years old (33%). The majority of consumers are graduates (46,67%) while their educational level is shown below:

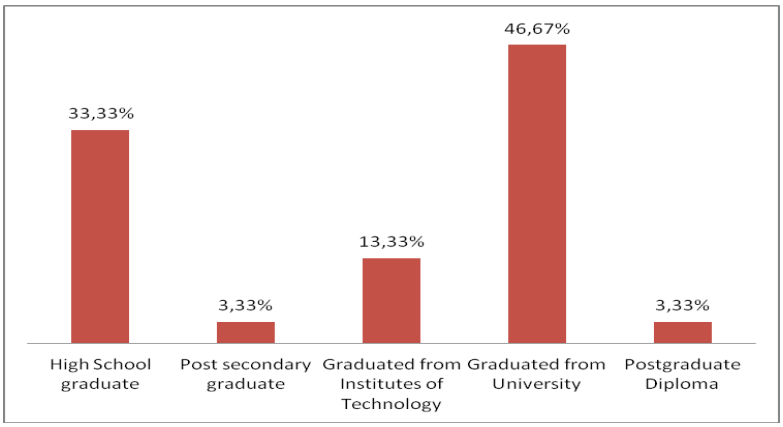

Fig. 2. Educational level

As far as marital status, most of them stated married, the rest stated unmarried and just one stated widow.

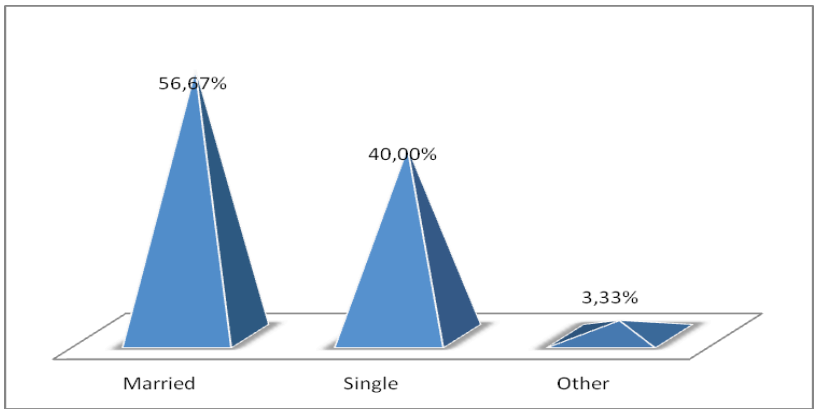

Fig. 3. Marital status

The monthly family income in euros which stated from consumers in depicted in figure 4.

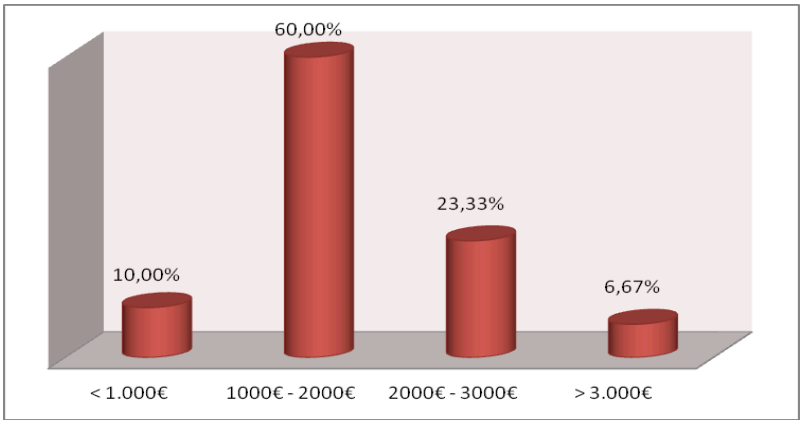

Fig. 4. Monthly family income

Related to their profession were stated the following: Aesthetics, household, pensioner, civil servant, unemployed, conservator or antiquities, radiologist, foreign language, teacher, martial university student, electrician, chemical, freelance, private employee, trader, state telephony company employee.

In all interviews the same questionnaire was used, which was done for the quality research, as during interviews a Dictaphone was used, to record five conversations in cassettes. Followed, there was a transcript of each interview and consumers were coded in each group as followed:
C1 consumer 1, C2 consumer 2, C3 consumer 3, C4 consumer 4, C5 consumer 5, C6 consumer 6.

The questionnaire, which was used consist of 42 questions quality containing, which means that the questionnaire is not strictly structured, but in open questions, so as the development of the conservation is determined mostly by the answers than the questions. In questions with free answer, which are called as narrative question or questions with narrative answer, the respondent is free to form its answer (Dautopoulos, 1994, p. 89). With this specific methodology, meaning conversations in consumer focused group, there was a possibility for many ideas to be listened, to argue and to face agreed opinions, so as to noted different views related to the effect of advertisement in fresh milk consumption and generally to externalize their beliefs and perceptions of thirty different people.

The results of this research are a starting point on the basis of this quality research‘s accomplishment.

6 The Results of Quality Research

All consumers who took part in this research stated that drink milk, especially fresh milk with diversity in frequency each one. Most of them drink a glass of fresh milk a day, while some drink more than that. Few of them stated that drink a glass of fresh milk every two days, while fewer stated that they drink less frequent. In the

question, if besides milk they drink other dairy products, the answers which were given were focused by half of them in chocolate milk, ariani, kefir, long life milk and condensed milk. The majority of the sample believes that the biggest general public of fresh milk is consists of children. In order of preference the answers are the elderly and teenagers. The vast majority of consumers stated that it prefers fresh milk of Greek origin, while just one of them stated that doubts about the true origin of fresh milk. Its taste, density, and content in nutritional elements, fat and high quality of fresh milk as a product, are according to sample the characteristics of fresh milk which make it appealing.

Cereals are the basic product which is used as accompanying for fresh milk's consumption. Other answers given:

- neat milk or just a slice of bread
- neat milk
- with bread and jam
- with coffee
- with croissants, cheese, pies, cakes
- with cocoa

Super market gathers the preferences of consumers in question related to the place that supplies fresh milk. Other suburban mini markets, bread shops, bakeries are followed, while few who comes from villages, reported buying milk directly from farmers. The criteria which consumers by fresh milk divert from one to another. The brand, taste, nutrient ingredients, quality, positioning, packaging, price and discounts are the answers which were given in this specific question. In question "How much are you influenced by milk's packaging" the majority of consumers answered that they are not influenced.

Just four of them replied that they are induced, while two consumers prefer exclusively carton or glass packaging. Fresh cow milk is preferred more than goat's, because the second one has got a smell which is unpleasant to many people. Some of them, though, did not had any special problem to drink goat's milk, while there was an answer that a member of a family drink goat's milk because cow's causes indigestion.

All the participants in research stated that they drink fresh exclusively at home, except one stated that drinks milk at work. The name of the product which produces and sells this fresh milk is a main factor for purchasing the product from the sample's consumers. Only two of those thirty people mentioned that they are not seriously influenced. As for the name of the company they prefer more for the purchase of fresh milk, Mevgal and Olympos lead their preferences, while there is Sergal, Koukaki Farm, Agno, Evrofarma, American Farming School, Delta, and Vrahias Farm.

Private label products have already gain many consumer's preference, because of their lower price, related to brand names products. Private label milk did not gain sample's consumer preference, since most of them replied negatively in related to question, justifying their attitude saying they are not aware of quality or even origin. Either branded goods or private label in milk, the majority of research's consumer stated that it is a necessary product in people's diet helping in children's growth with calcium provided and protects women in every stage of osteoporosis. Three of those

thirty people diversified, supporting just the opposite. Television, according to the sample is the main informative way for fresh milk. The rest of the answers were given in this specific question were the following:

- Internet
- All means of mass media
- Magazines
- Newspapers
- Acquaintances and friends
- Discounts coupons
- From the promotion in super markets

Most consumers show a negative attitude towards advertisement of fresh milk, while a few stated that they are positively influenced. Generally, for their information, consumers who participated in the research stated that they prefer watching television mostly at night, surf the net throughout the day, newspapers and print media mainly in weekend. In many of them, fresh milk's advert would play a significant role in order to change their purchasing habits. The following answers of them are really indicative:"I may buy it as an initial effect to advert" and "I would not mind. It depends on the star of the advert. If it was a person I admire, I would be easily influenced" correspondingly "I am only influenced if with the advert, there is a forwarding too" and "I like it a lot when I see or hear new things. In this way yes" I would be influenced of the advert that would describe the traditional way of production". Following the above question, eleven of these consumers stated that in the past changed their purchasing habits towards fresh milk's consumption, due to a very successful advertisement, while the rest of them answered negatively. Next consumers asked to answer in a question sets concerning factors connected to the promotion – display of fresh milk. More specifically were asked to answer the question – when advertisement of fresh milk is accepted – how important is for their purchasing decision the brand of the milk.

This sample in total answered that the brand and its advertisement is too important and maybe affect their purchasing behavior. On the contrary, four consumers answered that it was not at all important. In a question of how effected they are in their purchasing behavior, the messages of the advertised company related to the packaging, most consumers answered that it is the price that can influence remarkably their purchasing behavior, with only one of them stating "I do not note just the price. I always see price in connection to quality". Asked how influenced they are in their purchasing behavior, the messages of the advertised company connected to the discounts of fresh milk, the larger number of sample's consumers said that they would not be affected, while five of them answered positively, even if they do it only once. Asked how influenced they are in their purchasing behavior, the messages of the advertised company connected to the display of the production place, only five of them answered negatively while the rest answered positively. Asked how influenced they are in their purchasing behavior, the messages of the advertised company related to the display of a new product, most of them answered that they would be influenced.

7 Conclusions

All consumers who participated in the quality research stated that they consume milk and especially fresh milk with different frequency each one. Besides, fresh milk there are other dairy products consumed, such as chocolate milk, ariani, kefir, long life milk and condensed milk. The huge majority of consumers stated that they prefer Greek's origin fresh milk, while its taste, density and nutrient content, fat, high quality of fresh milk, as a product according to the sample's consumers and the special characteristics of it which makes it appealing.

They supply fresh milk from the super market, while the brand of the fresh milk's production company, the taste, the nutritional ingredients, the quality, the location, the packaging, the price, and discounts are the purchasing criteria of it. The name of the company which produces and sells fresh milk are the main factor for the purchase from the sample's consumers and more specifically prefer Mevgal and Olympos to buy. Television is the main mass media for fresh milk, followed by the internet, magazines, and newspapers. Most consumers show a negative attitude towards advertisement of fresh milk, while to a few of them a milk's advert would play a significant role in order to change their purchasing habits. The brand of fresh milk in advertisement is a very important factor and this may change their purchasing behavior. Also, the safety of fresh milk, its packaging and especially when a smart and practical opening way is advertised, the location display of the fresh milk's production and the display of a new product would affect consumers, when included in advertisement.

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Session 8: Sensor Technology Apps

A Low Cost Internet of Things Solution for Traceability and Monitoring Food Safety During Transportation

Mirjana Maksimović[1], Vladimir Vujović[1], Enisa Omanović-Mikličanin[2]

[1]Faculty of Electrical Engineering, University of East Sarajevo, East Sarajevo, Bosnia and Herzegovina, e-mails: mirjana@etf.unssa.rs.ba
[1]Faculty of Electrical Engineering, University of East Sarajevo, East Sarajevo, Bosnia and Herzegovina, e-mails: vladimir_vujovich@yahoo.com
[2] Faculty of Agriculture and Food Sciences, University of Sarajevo, Sarajevo, Bosnia and Herzegovina, e-mail: e.omanovic.miklicanin@ppf.unsa.ba

Abstract. In the last decade, we are faced with a dozen food crisis, which have impact on human health. EU as response to food contamination applies a set of laws and standards for food traceability through all stages of production, processing and distribution, forcing that all food and feed operators implement special traceability systems. One of the main and a crucial element of this system is food transport from manufacturer to consumer, and possibility for monitoring food quality through the transportation process. Applying new technologies, like Internet of Things (IoT), nowadays it is possible to connect food producers, transportation and hospitality/retail companies. A low cost solution based on IoT for real-time food tracebility and monitoring in food transportation process is presented in this paper.

Keywords: Food monitoring, Transportation, Internet of Things, Raspberry Pi

1 Introduction

Food safety today is defined as a public health priority and has been a growing concern among EU citizens over the last decades ("Food Traceability," 2007). It represents a scientific discipline which includes a number of routines and inspections between industry and the market and between the market and the consumer that should be followed to avoid potentially severe health hazards. Public concern about food quality has intensified in recent years and key global food safety concerns include: spread of microbiological hazards; chemical food contaminants; assessments of new food technologies (such as genetically modified food); and strong food safety systems (to ensure a safe global food-chain). Specific standards, such as ISO 22000, ISO 22005 and SQF for food traceability have been mandated internationally; by law in the European Union (EU), Japan, and more recently the United States; and by private firms and associations (Karippacheril et al., 2011). These standards ensure the ability to follow a food related material or product through all stages of the supply and distribution chain as a vital element for consumer safety (Kozlowski, 2012). According to EU law, this ability is called “traceability” and means the ability to

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track any food, feed, food-producing animal or substance that will be used for consumption, through all stages of production, processing and distribution ("Food Traceability," 2007).

The food safety system, based on defined standards, includes food production, processing, packing, distribution/transportation, storage and preparation. The research challenges connected to food safety can be summarized in (Vermesan and Friess, 2013):

- Design of secure, tamper-proof and cost-efficient mechanisms for tracking food contamination from production to consumers, enabling immediate notification of actors in case of harmful food and communication of trusted information.
- Secure way of monitoring production processes, providing sufficient information and confidence to consumers.
- Ensure trust and secure exchange of data among applications and infrastructures (farm, packing industry, retailers) to prevent the introduction of false or misleading data, which can affect the health of the citizens or create economic damage to the stakeholders.

A technology like mobile phones, radio frequency identification (RFID) systems, wireless sensor networks, global positioning systems - GPS (Karippacheril et al., 2011), and Internet of Things (IoT), as an important part of the new generation information technology, are applied in order to ensure efficient delivery and food safety, which are compliant with food safety and traceability standards. IoT is an emerging paradigm and a cutting edge technology which goal is to enable things/objects to be connected anytime, anyplace, with anything and anyone ideally using any path/network. The IoT applications are numerous and cover “smart” environments/spaces in domains such as: transportation, building, city, lifestyle, retail, agriculture, factory, supply chain, emergency, health care, user interaction, culture and tourism, environment and energy (Fig. 1) (Vermesan and Friess, 2013; Bassi et al. 2013). IoT nowadays makes possible a new cooperative between food producers, transportation and hospitality/retail companies.

Fig. 1. The Internet of Things applications (Ake, 2014).

Food contaminants can enter the food supply at any point from farm to table. With the help of IoT-connected testing equipment, food quality can be monitored as food leaves the factory or warehouse. In this way food companies across the supply chain gain the real-time visibility and enable the automated, intelligent actions needed to ensure high food quality, delivery on time and food preparation in optimal settings

(Jones, 2014). In this paper is presented a low cost solution based on IoT for real-time foodstuffs traceability and monitoring in transportation process. A low cost computer board (Raspberry Pi platform) is utilized as a central processing unit which provides a set of services for accessing sensor data, and communicates with end users, while different types of sensors (depending of target parameters) can constitute the detection module.

The rest of this paper is organized as follows. The state of the art is presented in Section 2. Section 3 presents requirements and challenges in food products transportation processes. A proposition of low cost IoT solution for food safety monitoring during transportation is given in Section 4. Finally, Section 5, based on the performed research and obtained results, provides conclusion remarks and outlines directions for future work.

2 State of the Art

Every stage of the food chain (food production and preparation processes, including packaging, distribution, etc.) should be carried out and monitored scrupulously to enhance food safety. Hazard Analysis and Critical Control Points (HACCP) is a scientific and systematic preventive approach to food safety, from biological, chemical and physical hazards in production processes that can cause the finished product to be unsafe, and designs measurements to scale down these risks to a safe point. HACCP is used in all stages of a food production and usually is referred as the prevention of hazards rather than relying on end-product testing ("Seven Principles," 2007; "Food Safety Management System," 2014). The seven principles of a HACCP system are ("Seven Principles," 2007): identifying any biological, chemical, or physical hazards, identifying the critical control points, establishing critical limits, monitoring critical control points, establishing corrective actions, verification and record keeping. Based on the before mentioned, a Food Safety Management System (FSMS) can be defined as a network of interrelated elements (programs, plans, policies, procedures, practices, processes, goals, objectives, methods, controls, roles, responsibilities, relationships, documents, records, and resources) that combine to avoid potentially dangerous health hazards.

To ensure that food reaches its destination in a safe condition without compromising quality, it is necessary to provide an environment that reduces the risk of contamination and protects food from various hazards. Also, there is a need to develop comprehensive and well-designed food contaminants monitoring systems. Food traceability system (production, inspection, supervision and consumption) didn't remain immune to continuous upgrading in IT sector. Bakucs et al. (2008) using a key technology survey investigated the likely future impacts of technology on food quality and health in six Central European countries. Falling cost of hardware and software accompanied with IoT paradigm affects the whole supply chain: starting with the production site, through transport and retail, up to the customer, and therefore can facilitate the whole process and improve the service (Bassi et al. 2013). Karippacheril et al. (2011) emphases in their work the significance of mobile devices, advances in communications, and greater affordability of nanotechnology in

traceability systems. The existing approaches in food traceability are summarized into: structured database solutions, RFID based solutions, barcode technologies, nanosolutions, DNA techniques and nuclear techniques. Commercially available hardware and software as well as solutions providers offer a variety of solutions for recording, storing and retrieving data. IoT based approaches for monitoring food safety in various stages of the food chain with the help of RFID and wireless networking can be found in (Aggarwal, 2013; " Elektron launches wireless food safety monitoring system," 2013; Hopper et al., 2008; Zeidler, 2010, Xu et al., 2013). Authors of (Martins et al., 2012; Hopper et al., 2008; Hsu and Shangguang, 2014; Ramesh and Das, 2012; Zhang et al., 2012) focused their research on monitoring food safety during transportation. The idea of Internet of Vehicle (IoV) is implemented in these works where the advantage of connected vehicles is highlighted. Accessibility of information nearly in real-time and the creation of a sensing network with a massive reach, amplified by the inherent mobility of vehicles are the main characteristic of proposed approaches. Solutions presented above are mostly low cost wireless remote systems with continuous and automated monitoring features and fast response. These systems are regularly accompanied with appropriate software. Keeping in mind that data is the backbone of any quality system, a data collection, analysis and reporting system must be established. In other words, proposed solutions collect process and store data, send alerts and warnings when specifications are not met and create reports. Therefore an automated data collection, along with the necessary analytical software is required in order to keep data collection costs low (Ryan, 2014).

A forementioned presented survey shows that the traceability information can be accessed through the Internet, and thus it can be concluded that IoT technologies provide efficient tools for data gathering, communication and sharing from different resources automatically. In other words, the IoT, accompanied with RFID, sensor technology, wireless communication and data mining techniques, provides unprecedented opportunities for product tracking. In such way, a food traceability system can make consumers understand the production and circulation process, and increase consumers' faith in the food itself.

3 Transporting Food Products

It is evident that there are so many types of foods with so many containers, temperature and handling requirements and so many modes of transportation available to the modern food company. Independently of the mode of transportation, foods and food ingredients are susceptible to abuse and/or contamination during transportation and storage. There are a number of interesting standards, compliance recommendations and laws that point to the development of a set of management, HACCP, sanitation, monitoring, transportation, and training standards. Preventive controls for food transportation safety hazards are identified by the expert panel and presented in detail in (Ackerley, et al. 2010). Ryan (2014) by reviewing documents published by the United States, Canada, Australia, Europe, China and Australia,

creates a general picture which can serve to guide the standardization of in-transit food safety systems.

One of the main documents which propose the hygiene rules in food total food chain for Europe is Regulation of European Commission EC No 852//2004 On the hygiene of foodstuffs ("Guidance document," 2012). It is mainly directed at food businesses and competent authorities, and aims to give guidance on the implementation of the new food hygiene requirements and on related subjects. It covers all food chain, from production to human consumption.

The regulation covers primary production. At the level of primary production, primary products have to be subject of following operations so as to ensure a better presentation, such as:

- Packaging without further treatment;
- Washing of vegetables, removing leaves from vegetables, the sorting of fruit etc;
- The drying of cereals;
- The slaughter, bleeding, gutting, removing fins, refrigeration and wrapping of fis;
- Centrifugation of honey to remove honeycombs.

Such operations must be considered as normal routine operations at the level of primary production. On the other hand, certain operations carried out on the farm can lead to the contamination of products e.g. the peeling of potatoes, the slicing of carrots, the bagging of salads with the application of packaging gases or the removal of gases. These operations cannot be considered as normal routine operations at the level of primary production nor as operations associated with primary production. The Regulation creates the need for food companies to establish, under the HACCP-based procedures, documentation commensurate with the nature and the size of the business. Together, this documentation will constitute operational procedures that are an important element in ensuring food safety.

The main focus of the Regulative ("Guidance document," 2012) is on the food transportation. As related to the transport, the Regulative emphasizes on:

- The transport, storage and handling of primary products at the place of production, provided that this does not substantially alter their nature;
- The transport of live animals;
- In the case of products of plant origin and fishery products: transport operations to deliver primary products, the nature of which has not been substantially altered, from the place of production to an establishment.

It is common for all primary products that conveyances and/or containers used for transporting foodstuffs should be kept clean and maintained in good repair and condition. Furthermore, to protect foodstuffs from contamination vehicles and/or containers should not to be used for transporting anything other than foodstuffs ("Guidance document," 2012).

Ryan (2014) states 15 food main risk problem areas during transportation: refrigeration and temperature control, transportation unit management (prevention, sanitation, etc.), packing, loading and unloading, security, pest control, container design, preventive maintenance, employee hygiene, policies, handling of rejected loads, holding and traceability. Therefore, no matter what kind of food commodities

and products are transmitted, they all require common multiple steps in their transportation between point of origin and point of use in order to ensure safe food products transportation and to avoid any contamination (Keener, 2003).

Recent trends in food safety are focused on miniaturization of analytical procedures through application of sensors, biosensors, microchips lab-on-a-chip, or micro total analysis systems (Mirasoli et al., 2014). This will allow fast detection of possible contamination especially during transportation. Different parameters as indicators of contamination of foodstuff could be measured by miniaturized devices. These parameters could be temperature, humidity, chemical contaminants, microbial contaminants etc. Increasing of temperature and humidity cannot give information about the type of contamination which will occur but it is a sign of contamination in many types of food stuff (milk, meat, plants etc.). Thus, temperature and humidity can be taken as parameters to follow in sensor design in order to have universal sensors for many different foodstuffs.

4 A Proposition of Low Cost IoT Based Solution

Sensors are a key enabler in the realization of an IoT and many of the objects associated with the IoT are sensor-based systems. With the help of sensors in food safety system, temperature, humidity, carbon dioxide, heavy metals and other environmental conditions in fields, as well as perishable items during transport can be monitored. In this paper the creation of an economical, sensor based remote monitoring system using cost-saving technology based on cheap computer board and wireless communication modules is proposed.

The presented solution is based on two elements: a traceability (which provide information about a product which is tracked and monitored) and monitoring (which provide a state of the product and its environment). The main function of food traceability and safety monitoring system is to provide information and record keeping procedures that indicate the path of a product unit, a group of products or ingredients from a supplier, through all intermediate steps along the food chain to the final consumer (Zhang et al., 2011; Ene, 2013). For the fulfillment of the set functionalities, together with rapid technology advancements, a several key requirements which depend on global principles can be defined (Zhang et al., 2011; Ene, 2013):

- Wireless, light weight, small size, low cost solution equipped with accurate and stable sensors for an essential variable;
- Ruggedness and transportability;
- Non- or minimally-invasive;
- Compatibility and standardized information;
- Defining the resources and identification of lots of products;
- Continuous monitoring functions and real time food safety data gathering at each decision point;
- Recording information on the production process and establishing links between information;

- Sending the result to the cloud automatically so that can be viewed online in a presentation form that is easily understood;
- Food safety emergency response system: immediate recall and preventive elimination of potential hazards.

Aforementioned requirements represent a main guideline for building a custom monitoring system which can be applied on global scale issue.

To ensure traceability, a system must implement a set of GS1 standards which is de facto default way for communication of customers, suppliers and partners. GS1 provides a concept and technology for efficient way of accessing information about items in their supply chains, and share this information with trading partners. All organizations must be a member of GS1, and they obtain a GS1 company prefix which forms the basis of ID keys, unique identifiers for products, documents, physical locations and more. A technology which GS1 provides for identification of products is 1D and 2D barcodes, and lately commonly used a RFID tag which will be used in our case. For monitoring, sensor unit represents a main building element which can be combined based on user needs and monitor different elements and parameters of products and its environment.

Hardware implementation of proposed system is based on Raspberry Pi (RPi): a credit card sized, powerful and lightweight ARM based computer board which has support for a large number of input and output peripherals, and network communication what makes it the perfect platform for interfacing with many different devices and enables an almost limitless choice of its uses. RPi is running on Linux (version A, A+, B, B+, B2) or Windows 10 (version B2) operating systems, and the whole unit is powered with 5V and 200-800mA current, what implies a low-level consumption of 1-4W (depends on version). Internet connectivity may be via an Ethernet/LAN cable or via an USB WiFi, WiFi Shields, Bluetooth, WiFi/Bluetooth USB Combos, RF Add-ons and cellular solutions (3G/4G USB modem or GSM/GPRS shields). RPi usage as a hardware for building an IoT solution with in detail presented analysis of its performance and constraints is given in (Vujović and Maksimović, 2014). A complete solution of RPi utilization in home automation is presented in (Vujović and Maksimović, 2015), while proposition of communication over GSM/GPRS is given in (Vujović et al. 2015).

Relaying on presented knowledge, defined requirements and conclusions from Section 3, a proposition of custom solution is built and it is shown on infrastructure diagram in Fig. 2. In order to create as much as possible universal solution for monitoring many different foodstuffs during transportation, the cargo area (container, trailer) is equipped with Raspberry Pi unit (as a central processing unit) and sensors for measuring temperature and humidity (digital or analog temperature sensors). The advantage of the proposed system is the fact that additional sensors, depending on special food product monitoring requirements, can be easily added. Beside of that, a whole system is connected to devices for scanning and reading a cargo items (box, pallets, barrels, etc.), usually RFID but also a Near Field Communication (NFC) or Bluetooth devices can be used. In this solution, RPi behaves as a Web service (RESTful Web service) with unique address and provide worldwide access over the Internet (for sending measurement data) which is done over Wireless 802.11 or GSM/GPRS module. After the cargo is being loaded on transportation vehicle, an

RPi make a scan with middle range RFID and detects all items. When items' detection is completed, a list of cargo items can be read from Central Monitoring System (CMS) or accessed through unique Uniform Resource Identifier (URI) address, depending on further analysis. CMS detects and links items to GS1 database, recognizing the essential parameters for monitoring (in our case temperature and humidity) during the transportation process, and implements a simple (reading values from sensors and alerting when monitored parameters are disturbed) or complex (a fuzzy logic or neural network based systems for decision-making) monitoring system.

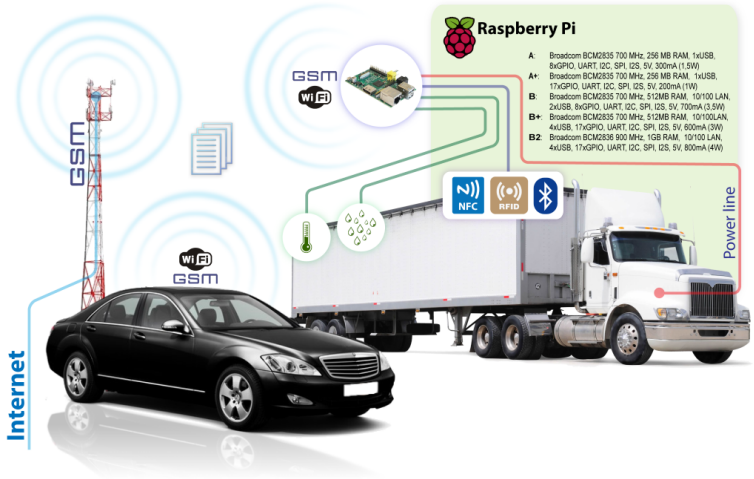

Fig. 2. Monitoring food safety during transportation.

Monitoring parameters of interest, this solution can provide an instant real-time view into food safety and trigger alerts if problems occur so they can be caught before real damage is done. The whole system can be powered from a vehicle or autonomous battery power supply. Optionally, the proposed solution can be used in the creation of sensor networks in connected vehicular environments.

5 Conclusion

Food safety is a main concern nowadays, and therefore it is crucial to have a system which enables foodstuffs traceability and monitoring during the whole food chain process. This paper, beside presented food safety requirements and existing systems, proposes a low cost solution based on IoT. The advantages of presented system for foodstuffs monitoring during transportation are: low cost, small size, flexibility, rapid system expansion, real time access and automatic cargo identification. Future research will be focused on interconnecting vehicles, sensors, and mobile devices into a global IoV network, what should enable various services to

be delivered to vehicular and transportation systems, and to people within and around vehicles.

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Markup Languages Support for Content Management of Agricultural Portals

Jan Masner[1], Jiří Vaněk[2], Jan Jarolímek[2], Vladimír Očenášek[2]

[1]Department of Information Technologies, Czech University of Life Sciences, Czech Republic, e-mail: masner@pef.czu.cz
[2]Department of Information Technologies, Czech University of Life Sciences, Czech Republic

Abstract. Within a wider research, the Department of Information Technologies of CULS Prague works on a project, which deals with methodology for creation, updates, store and presentation of information content in the WWW environment. This paper provides analysis of markup languages and discusses other proposals for the future research and development. The results of this study indicate that the HTML5 language should be used as a main carrier. An abstract envelope (using XML, JSON or both) should be defined to keep information content in blocks to allow portability, communication with CMS, mobile devices or other applications.

Keywords: HTML, WWW, CMS, Information content, WYSYWIG.

1 Introduction

Internet and the World Wide Web environment have rapidly spread over the population during past years. Number of web pages and portals is still growing. Recently, there are more than 1.2 billion of web pages online (Internet Live Stats, 2014). The past decade has seen the rapid departure from classical printed media (newspapers, magazines). At the same time, the number of online media and portals grows. Establishing and managing of such websites is becoming easier. These trends are expected for the future to be more significant. The online publication and online content brings many opportunities (Das et. Al, 2009).

Due to a development of internet technologies, especially content management systems, even users without knowledge of desired technologies (HTML, CSS) can manage the online content (Brown, 2014). This usually means creation of posts like articles, news, interviews, etc. The main part of the content creation utilizes WYSIWYG (What You See Is What You Get) editors. Other tools of content management systems and content parts are connected in addition (photographs, links to related content, external links and attachments in general). WYSIWYG editors allow users to work with the content without knowledge of the desired technologies the same way like any text processors do. However, this suffers from many limitations.

Due to a lack of knowledge of HTML and connected CSS, the work with advanced features (such as floating property) is difficult. WYSIWYG editors and

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tools are not perfect and can lead to problems with inconsistency of output. These issues need to be solved programmatically then (Spiesser and Kitchen, 2004). Digital form of online media and content offers an undiscovered potential of opportunities. The textual content can be extended by various components such as images with description, galleries, links, maps and interactive objects in general etc.

There is a need for analysis of the content storage form. Recent content management systems uses various types of WYSIWYG editors, which can be extended by additional elements. There are many modern technologies for content sharing, searching and classification such as semantic web, metadata description (e.g. AGROVOC), sharing (e.g. OAI-PMH), Internet of Things and cooperation with mobile devices (Šimek et. al, 2013; Šimek, Stočes and Vaněk, 2014).

Within a wider research, the Department of Information Technologies of CULS Prague works on a project that deals with methodology for creation, updates, store and presentation of information content in the WWW environment. The methodology should cover modern trends in the informatics area such as usability, User eXperience (UX), Internet of Things (IoT), connection with applications for mobile devices, etc. Finally, it should be generalizable and usable for various types of contents in different areas. Regarding the agrarian sector where IT technologies penetration and knowledge of desired technologies is at a lower level, the importance of the research topic is significant.

The objective of this paper are to determine whether the HTML5 language is optimal to be used in the target methodology. In addition, the study analyses other initial aspects for the research project.

2 Materials and Methods

The following section deals with the analysis of the Hypertext Markup Language (HTML) and its changes during the specifications development. The main objective is to determine, what are the most important changes regarding the information content and what changes are expected for the future. Additionally an overview of content management systems is presented as well.

Tim Berners-Lee formed the HTML in CERN (the European Laboratory for Particle Physics in Geneva) laboratories in 1989. The basic idea was to allow an efficient organisation and availability of scientific documents from remote places. However, instead of making the documents simply available to download, they should have been linked together by hypertext links. Design of the language was based on SGML standard (ISO 8879:1986 Information processing - Text and office systems - Standard Generalized Markup Language). As Ragget (1998) writes: '*The SGML elements used in Tim's HTML included P (paragraph); H1 through H6 (heading level 1 through heading level 6); OL (ordered lists); UL (unordered lists); LI (list items) and various others. What SGML does not include, of course, are hypertext links: the idea of using the anchor element with the HREF attribute was purely Tim's invention, as was the now-famous `www.name.name' format for addressing machines on the Web*.'

The first HTML version was not standardised anywhere and so does not have any version name. The first official version HTML 2 was introduced by IETF (Internet Engineering Task Force) working group in 1994. Later the specification development was moved to World Wide Web Consortium (W3C).

The following chapters analyse HTML specifications based on appropriate specifications by W3C.

2.1 HTML 4.01

The specification version 4.01 was the first widely spread and used version. The W3C recommendation 4.0, later revisioned to 4.01 was released in December 1999 (W3 CONSORCIUM, 1999). In terms of information content, most of the specification is important. Chapter 14 (W3 CONSORCIUM,1999) mentions support for CSS styling. Later, this aspect appeared to be a key factor in defining the look of websites. The specification covers elements for several textual content types. For the research purposes we can define several key chapters and parts of the language:

- 7.5.1 Headings
- 9 Text
- 10 Lists
- 11 Tables
- 12 Links
- 15 Alignment, font styles, and horizontal rules

One of the most important aspects for the study objectives is the language syntax. The HTML till 4.01 version was based on SGML – so it is an application of the standard. Most important rules are:

- Element names are always case-insensitive
- Certain elements were permitted to omit the end tag
- Attribute names are always case-insensitive
- Attribute values can stand without quotes (under certain conditions)
- Some attributes have no value

2.2 XHTML

In 2000 a new specification was introduced. *XHTML 1.0* was released and in 2002 revised. This version is still used on many websites, but is continuously replaced. As W3 CONSORCIUM (2000) writes: '*XHTML is a family of current and future document types and modules that reproduce, subset, and extend HTML 4*' Actually, in terms of information content, the specification is nothing else than reworked HTML 4.01 using rules of XML.

The main differences cover 2 aspects. First, attribute name as identifier for elements *a, applet, form, frame, iframe, img,* and *map* is formally deprecated. The ID reference type from XML should be used instead. Second and more important change is in syntax. Since XHTML is an application of XML instead of SGML, the use of

tags, elements and attributes has more limitations. Generally it has to agree with XML syntax and rules. The most important aspects follow:

- Elements and attributes names are always lower case (XML is case-sensitive) - ~~*<BODY>*~~ → *<body>*
- All elements must have end tags - ~~*
*~~ → *
*
- Attributes must have a value
- Attribute values must always be quoted - *class=bold* → *class="bold"*
- Overlapping of elements is not permitted (must be well-formed)
  - ~~* here is an emphasized paragraph. *~~
  - * here is an emphasized paragraph. *

In 2010, W3C released the specification XHTML Modularization 1.1, which is and abstract modularization of XHTML (W3 CONSORCIUM, 2010). On the basis of this document specification *XHTML™ 1.1 - Module-based XHTML* and *XHTML Basic 1.1 - Second Edition* was created (W3 CONSORCIUM, 2010). The main (and only) contribution was the modular architecture. So it is based on several modules that relies on certain areas. The specification was not widely used probably thanks to already ongoing development of HTML5. The XHTML 1.1 specification is based on Strict variant of 1.0. Regarding the information content, there are only two differences. Firstly, the element *name* was finally removed and is now obsolete. Secondly, element *ruby* has been added.

2.3 HTML5

Originally the development of HTML5 was performed by *WHATWG* group. The first public draft by W3C was released already in 2008 during the finishing of XHTML 1.1 (W3 CONSORCIUM, 2008). Final recommendation was released in 2014 (W3 CONSORCIUM, 2014). Nowadays the HTML5 is the most widely spread version used on websites (Power Mapper, 2015) as shown on Figure 1.

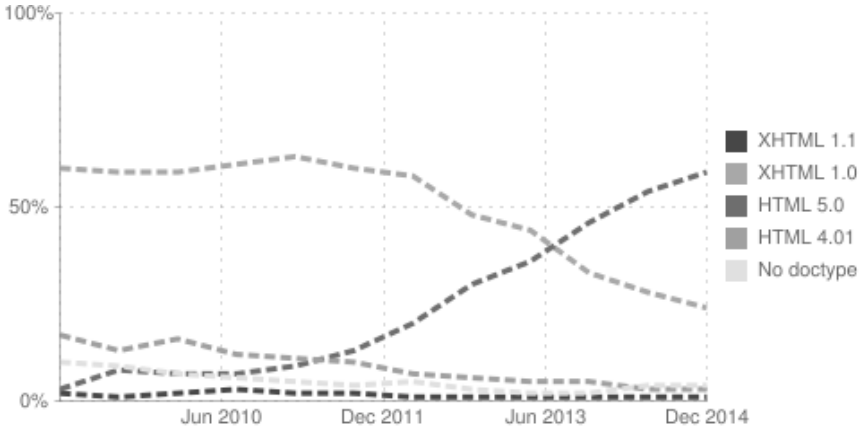

Fig. 1. HTML and XHTML language specifications used by websites.

HTML5 specification covers specification of abstract language as well as a set of APIs. The syntax is defined as two types – *HTML 5* based on HTML and XHTML 5 based on XML (XHTML). The HTML syntax comes from the original 4.01 with almost all rules and is recommended for developers. HTML5 is not – by the syntax – an application of some general language. The specification covers complete language definition and does not appeal to any other ones.

Main changes in HTML5 in terms of information content comprise a set of applicable elements and attributes. Some of them are now obsolete including elements *font, listing, strike, big, center*, or attributes *name, summary*, etc. On the other side, there are many new elements bringing new possibilities for semantics.

The future development version – HTML 5.1 (W3 CONSORCIUM, 2015) currently points out only unimportant small changes and improvements. No elements or attributes are removed. In terms of information content, only small improvements on semantics have been recently expected. The specification is currently in Working Draft phase, so changes are expected.

2.4 Content Management Systems and Information Content

Content Management Systems (CMS) store content differently. However, WYSIWYG editors are utilized by most of them for the main part of content. Then it can be extended by another attachments. The WYSIWYG editors can usually add these attachments as well. However, working with such content is limited. Since it is part of the main content, automatic separating is difficult and can lead to inconsistency of the source code. Some CMS solves the problem by composition of blocks of content. E.g. Drupal can add so called fields to post types (nodes). Each node type has a given structure (template), which cannot be changed for node instances. An example is shown in Figure 2.

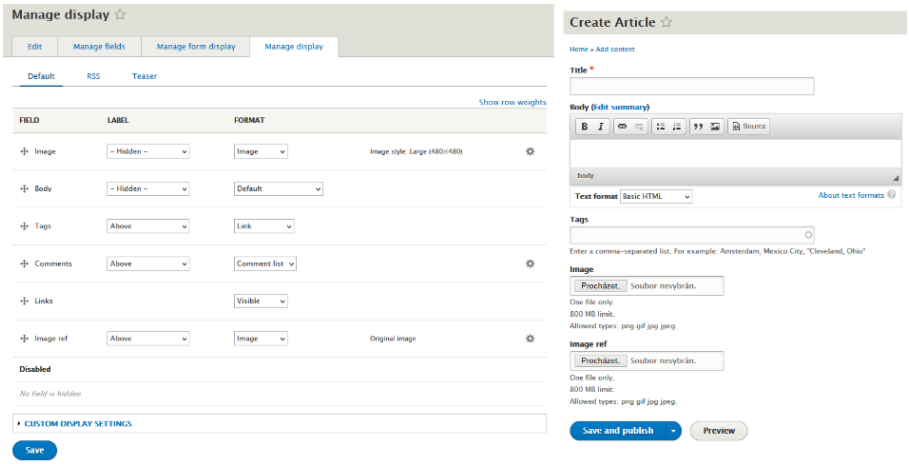

Fig. 2. Example of creation of node in Drupal CMS. The left side shows defining the structure template. The right side shows authoring of content instance (node)

A change of the template affects all existing node instances (e.g. articles). It can even lead to a data loss. Each field is in a separate table or a table attribute (based on configuration). Other CMS approach these issues in a similar way, an example of WordPress is shown in Figure 3. Content fragmentation dependent on the configuration of certain CMS leads to a limited portability of content. Problems can appear when upgrading to a newer version of CMS, change to a different one or even archiving.

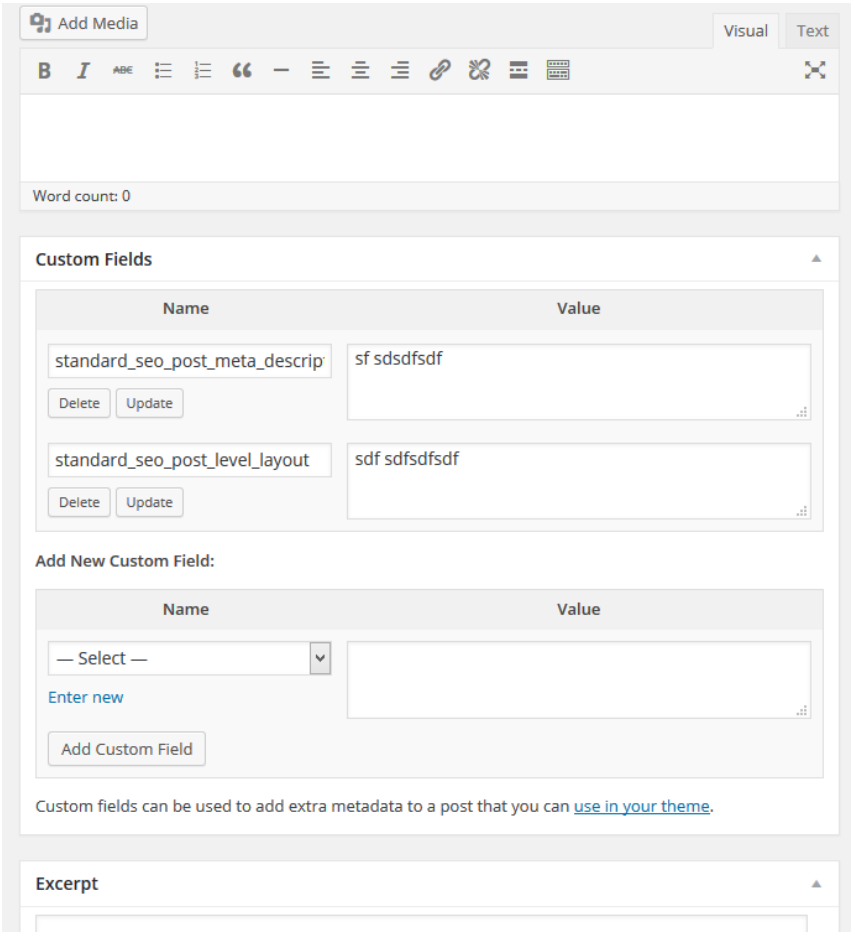

Fig. 3. HTML and XHTML language specifications used by websites

2.5 Long term research and investigations

The Department of Information Technologies in cooperation with university newspapers (online magazine) has accomplished several observations and experiments with content authors. The department also operates portal Agris.cz,

which is one of the most frequently visited information sources of the agrarian sector in the Czech Republic. Several interviews were run as well.

3 Results

The analysis of HTML in previous chapter was used to determine, how the language specifications changed in terms of information content. Any essential changes were not observed and are not expected for the future.

The analysis of content management systems and other researches suggests the creation of content by composition of separate blocks as a right approach. However, the current solutions are limited due to fixed structure of block. Instances of content are lack of independent ordering of these blocks. This approach also supports the requirements for connection with mobile devices.

Long term research and the cooperation with university newspapers and Agris.cz portal suggests that users have problems with editing advanced content elements. More advanced features of editors can be difficult, especially when it needs some re-edition. The key problem areas can be classified as follows:

- Tables containing pictures
- Floated objects (elements)
- Insertion of automated content parts (from CMS)
- Galleries
- Movements of parts of content inside editor (tables etc.)

Other research results suggest to offer predefined blocks of content to content authors. These blocks are easier for editing and take advantage of the unified final presentation on a website.

4 Conclusion

The results of this study show several conclusions for the further research and project process. The HTML5 can be used for the carriage of main information content parts. In terms of storage, the study suggests to extend it by division into blocks, which can be processed separately. This approach should support the ordering of the blocks independently for each content instance.

These findings suggest that HTML5 language needs to be wrapped in some abstract envelope, which supports the mentioned features. There is a need to define interface for communication and cooperation with content management systems or other applications. Further research should focus on determining the exact form or markup language to be utilized within the target methodology. Using JSON or XML in combination with HTML5 suggests itself to be explored. The following conclusions can be drawn from the presented study:

- The HTML5 language specification is not expected to essentially change

- The language needs to be wrapped in an abstract envelope to support several requirements:
    - Communication with CMS or other applications
    - Allowing support to communicate with mobile devices
    - Universal approach and portability of the content
    - Support for metadata description (e.g. OpenGraph, AGROVOC), correct semantics, sharing (e.g. OAI-PMH), Internet of Things
- Further research should focus on:
    - Useful and user friendly UI (User Interface)
    - Easy and fast content authoring from any device
    - User eXperience measurements
    - Minimizing of input errors in terms of valid and consistent presented output on websites
- Storing of structured data independently on the look of final output
    - Different devices can have different demands on UI

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Tomato Fruit (*Lycopersicum esculentum* Mill) Maturity Study Based on Sensorial Analysis and Instrumented Color Determination

Celina de Almeida[1], Inacio Maria Dal Fabbro[2]

[1]PhD Eng, Consulting Engineer, Campinas, SP, Brazil, e-mail: celinalmeida@yahoo.com.br
[2]PhD Eng, Professor, Faculty of Agricultural Engineering, State University of Campinas, Campinas, SP, Brazil, e-mail: jinacio@feagri.unicamp.br

Abstract. Table tomatoes (*Lycopersicum esculentum* Mill) have been tested during maturation process by carrying color determination by means of instruments as well as trough sensorial analysis, aiming to stablish data correlation between both methods. Recent picked testing fruits were selected by taking into account an uniform physiological maturation considered adequate for harvesting. Fruits were presented to a group of trained volunteers and employing a non-structured scale. Instrumental readings were carried by means of a "Macbeth" HUNTERLab equipment at five points selected on the transversal fruit axis. Sensorial color determination did not present significant difference ($p \leq 0.05$) between the days 1, 3 and 5; 5 and 8; 10 and 12; and 12, 15, 17 and 19, however differences were noted between these groups. The fruits showed moderated characteristic colors between the 10th and 12th day and very characteristic colors from the 12th.

Keywords: Tomato fruits, fruit color, fruit maturation, sensorial analysis, instrumental color determination.

1 Introduction

Tomato is considered the horticultural crop of major worldwide commercial interest. As reported by the FAO (2014), world consumption of tomato in natura guarantees the second place of importance. Tomato is cultivated in different zones of Brazil, in all the seasons as well as in a variety of crop handling systems. These details promote a high production, placing the country among the bigest tomato producers in the world, as China, USA, Italy, Turkey, Spain, Egypt and Mexico (Cardoso et al 2010). The total área devolted to tomato crop in Brazil reaches 66.418 hectares which produces 4,146,466 metric tons a year, yielding 62.616 kg/ha. IBGE (2012).

Tomato is a climacteric and perishable fruit which requires adequate storage conditions in order to delay ripening process, to minimize losses as well as to increase shelf life (Brackmann et al., 2007). Only fruits meeting expected qualities by the consumers will be considered for commercialization. Color is an important

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quality attribute which is close associated to maturity and together with shape, size, firmness, bruising and defects will support consumer selection.

Fruit color perception is associated to some characteristics as the combination of certain pigments. Small changes of fruit color are connected to certain factors as maturity, exposition to radiant energy, size, burning, tanning, etc Little (1973).

As reported by Nickerson, apud Lozano (1977), color can be determined through an appropriate system based on tonality, luminosity and on the chromaticity of our sensations. Instead of describing them, MUNSELL developed a system which stablished the three color dimensions and measuring each one of them by referring to an appropriate scale.

As reported by Setser (1984), due to variation, the surface characteristics have to be standardized before submission to color determining instrument. In case of non-homogeneous distribution, the readings should be repeated in order to increase the data reliability. Hobson et al (1983) reported an objective method to define composition changes during maturation process by setting tomato fruits in a varying degree of maturation. Initially, the authors restricted the test to a cultivar and used a spectrophotometer of the HUNTER Lab system. Color has been measured during fruit maturation after carrying sensorial analysis in a color sequence. The authors conclusions referred to the applicability of the proposed method to other cultivars in a varying maturation levels.

Thai, Shewfelt (1991) presente a physical analysis of tomato color by means of an HUNTER Lab SYSTEM spectrophotometer calibrated with a rose pattern model. Eight spaced readings have been carried out around the fruit equator and recorded in software. The resulting mathematical model involving “C” (chromaticity) and “H” (tonality) which hae been statistically analyzed. The authors verified that “L”, “H” and “C” were correlated to sensorial color perception.

Borguini, R. G.; Silva, M.V. in 2005 determined texture, other physical properties and color of Debora and Carmem tomato cultivars produced under organic as well as under conventional agricultural practices. Sensorial analysis of these samples indicated no difference for red tonality between both agricultural practices. Instrumental color readings adopted the mathematical model for C (chromaticity) and h (tonality). It was observed that L,h and C yielded good correlation for subjective color.

Thai, Shewfelt (1991) reported an experimental evaluation of tomato color based on the Shewfelt et al (1987) method adapted to red tomatoes. Volunteers were trained to designate grades in a non-structured scale on a line of 150 mm of length, showing an initial mark de 0 to 12, where 0 indicates no-red color, next to 75 mm indicating light red color and 138 mm indicating total red color.

Borguini, R. G.; Silva, M.V. (2005) comments that the “h” parameter defined the basic sample color and also represented the average sample tonality. The authors also verified that as great as the color angle “h” it means that fruit color was close to the yellow and as the small the angle the close to red was the color. It was also noted non-significant difference of red color when compared the fruits produced by both agricultural practices. Tomato shelf life is influenced by the maturation level at which the fruits were harvested and stored.

2 Materials and Methods

2.1 Materials

In the experimental part of this research work the tests were carried with table tomato Santa Clara cultivar I 5300. The choice of that cultivar was based on the productivity reached in the area of Campinas, SP, Brazil. Tomatoes were direct picked on the field during morning period. Physiological maturity level, uniformity, free of bruising, as stated by the IFT (1981).

Difuse Reflectance Spectophotometer. Tomato color analysis carried during the storage period was tested by a MACBET 1500 plus model in the Laboratory of the Chemistry Institute at The State University of Campinas, SP, Brazil, where all the instrumental fruit color determination were carried out. Spectophotometer readings were transmitted to a software available in the instrument, where they were codified and stored.

During reflectance measurement by the Hunter Spectrophotometer, the incident light beam was reflected as a diffuse beam which was collected and measured by the sphere as is displayed. The spectrophotometer emits a light beam which does not inside perpendicularly onto the sample surface.

The spectrophotometer was developed by HUNTER in 1950 based on the Hering Opponent-Process Theory. Color determination refers to red and green as well as between yellow and blue. Three dimensional view representing the color determination results, where 1) the dimension +a and –a refers to the chromaticity red-green, 2) the dimension +b – b refers to the chromaticity yellow – blue, meanwhile the dimension L measures luminosity.

Sample chromaticity was obtained through the equation:

$$C = (a^2 + b^2)^{1/2} \quad (1)$$

which represents the hypotenuse of the rectangle triangle having “a” and “b” as sides, as shown on Fig. 2. Tonality was obtained through the angle “H” obtained by

$$H = tg^{-1}(a/b) \quad (2)$$

The fruit total color variation is given by:

$$(\Delta L^2 + \Delta a^2 + \Delta b^2)^{1/2} \quad (3)$$

Where ΔL, Δa and Δb stands for the reading differences between the first and the second day of observation, as reported by Little (1982). Where c= chromaticity, -a to +a = green to red color, -b to +b = blue to yellow color and H = tonality.

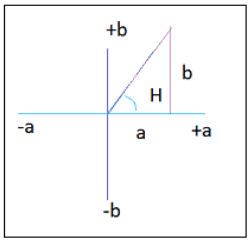


Fig. 2. Scheme for three dimensional color measurement.

2.2 Methods

Preliminary analyzis - Commercial classification. The commercial tomato classification directed to "in natura" consume for the domestic market was based on the Brazilian Program for the Horticulture Modernization – Tomato Classification Norms, Horticulture Quality Center, CQH/CEAGESP.

Preliminary analyzis - Physical properties. Fruit dimensions were surveyed by means of a caliper, by selecting a number of 24 individuals at random, taking into consideration the fruit shape. Specific weight determination was based on the Archimedes Principal as recommended by Mohsenin, N. N. (1965). The fruit was placed in a 1000 ml beaker together with 500 ml of water avoiding contact between fruit and the glass sides. The displaced water volume was calculated by means of equation (4).

$$P_r=(P_f.D_{H2O}/P_d) \quad (4)$$

Where "P_f" – fruit weigth in grams - "D_{H2O}" stands for water density given in g/cm3 - "P_r" is the real specific weight in g/ml.

In order to determine the apparent weight it was employed a container with the dimensions of 31x18x11 cm having a volume of 6138 cm3 which was filled with the fruits in a natural way, i.e., without interference, without excess or missing fruit. Tomato weight was calculated by the difference between the total weight and the container weight, as indicated by the equation (5) as recommended by Mohsenin, N. N. (1965), as

$$P_{ap}=(m/V_r) \quad (5)$$

Where “m” is the product mass in g, “P_{ap}” is the aparente specific weight in g/ml, “V_r” is the container volume in ml.

After determining the real and apparent weight, the porosity was obtained by equation (6) from Mohsenin, N. N. (1965).

$$P=(1-P_{ap}/P_r)x100 \quad (\mathbf{6})$$

Where “P” is the porosity in %, “P_{ap}” is the apparent specific weight in g/ml and “Pr” is the real specific weight in g/ml.

Preliminary analyzis - Sensorial analysis judges selection. Judges training took place in the three weeks preceding the experimental phase. Initially 30 individuals including men and woman have been invited as volunteer judges. Individual’s acuity have been evaluated following FARNSWORTH MUSELL – 100 - HUE (1957) recommendation for color description. Following that preliminary test, 23 individuals having normal vision for color were selected. In the next step individuals were selected for discriminative ability for color, judgment reliability and consensus with the remaining individuals. Significant differences were noted between individuals.

A non-structured scale of 9 cm of length based on the IFT (1981) was anchored at the ends ranging from “nothing” (for totally green fruit) to “well characterized” (for totally intense red tomato). During the test the judge is supposed to mark the identified color on the line.

Selection tests have been set by including 05 fruits for each judge with three replications each, from which the F test was carried for the Analysis of Variance, where P varying from ($F_{calculated} \leq 0,30$) $\geq 0,05$ is the probability of acceptance of the difference between judges, concluding that significant difference between judges did not occur. Based on that, nine judges have been selected, (Banzatto e Kronka, 1989).

Experimental analyzis. - Sensorial analyzis for color. A set of 20 tomatoes a day randomly selected from the initial group was used as recommended by Gormley, Keppel (1976) and presented to nine judges previously selected. Each judge carried individual evaluation of the samples checking his perception on the scale as explained before.

Color tests were carried out under the day ilumination which Windows were facing the north direction and iluminated with fluoresecent light as recommended by FARNSWORTH MUSELL 100 HUE (1957).

Experimental analyzis. - Color Instrumental Analysis. Following, after the sensorial tests the 20 individuals were analyzed through the diffuse reflectance spectrophotometer, using an observation angle of 100, in the CRIIS configuration, D illuminant and L,a,b patterns. A number of five readings were carried out on each fruit surface. The HUNTER Lab, system was used as recommended by Litle (1982).

Experimental analyzis. - Statistical analyzis. The statistical analysis was carried primarily to verify the differences between the parameters under consideration, i.e., L, a, b, c, DE as well as the sensorial analysis through the analysis of variance and Tuckey test at 5%. (Banzatto and Kronka, 1989).

3 Results and Discussion

3.1 Commercial Classification

Lycopersicum esculentum Mill, Santa Clara I 5300 cultivar exhibits an outstanding productivity and used for "in natura" consumption. Cultivar characteristics included oblong and bilocular fruit, indeterminate growing plant with 110 days (summer) of productive cycle, cultivated with anf average number of twenty thousand plants per hectare. Seeds germinate in 5 days and harvesting takes place in 100 to 110 days after seeding. That variety is tolerant to *Fusarium oxysporum* 1 e 2, *Verticillium dahliai*, *Verticillium abloatrum* and *Stemphylum*.

Fruits were harvested at the physiologically developing point showing uniform green color, homogeneous size and free of bruising, being classified as:

- Group "I" – Fruits present the longitudinal diameter larger than the transversal one.
- Class "big" – Fruits present a minimum diameter of 62 mm.
- Type "Extra" – The summation of defects did not exceed 7% of the total number of analyzed fruits.

3.2 Physical Properties

Table 1. Presents the average values of Real Specific Weight, Aparent Specific Weight, porosity, Size as well the respective standard deviation of the fruits included in the analysis.

	real specific weight(g/cm^3)	apparent specific weight (g/cm^3)	porosity (%)	size average values (cm) obliqúe	real specific weight (g/cm^3) distance
Average	0.957	0.550	43.60	6.61	6.81

3.3 Instrumental and Sensorial Analysis.

Table 02 presents average values of the sensorial and instrumental determinations for the color parameter during the maturation period. Table 03 displays the analysis of variance results.

Table 2. Sensorial and color analysis daily average results of 20 fruits.

Day	sensorial color	color "a"	color "c"	color "H"	color "L"	color "b"	color "ΔE"
1	1.5	-5.11	21.97	103.52	49.46	21.33	54.11
3	1.33	-4.54	21.41	102.17	49.13	20.73	53.51
5	2.03	2.98	21.56	96.72	47.16	21.02	51.72
8	3.86	6.06	23.23	76.1	42.29	21.24	50.39
10	5.5	7.98	23.76	67.38	42.02	20.94	47.62
12	6.67	15.11	25.71	53.1	40.22	19.74	47.28
15	7.54	16.24	23.97	45.4	38.09	17.73	45.04
17	7.85	17.96	25.41	45	37.75	17.88	45.47
19	8.22	20.03	26.09	40.33	36.74	17.59	45.39

Table 3. Analysis of Variance (ANOVA) results for the variables considered during the fruit maturation period.

	P>F	**C.V.**	**R^2**	**average**
Sensorial color	0.0001	40.42	0.63	5.05
Color "a"	0.0001	57.11	0.83	7.83
Color "c"	0.0001	9.66	0.37	23.66
Color "H"	0.0001	16.82	0.82	70.34
Color "ΔE"	0.0063	121.33	0.12	11.78
Color "L"	0.0001	13.62	0.39	41.94
Color "b"	0.0151	18.2	0.11	19.34

C.V. – Coefficient of variation; P>F – level of significance; R2 – Coefficient of correlation. data univariate analysis (ANOVA)

The ANOVA for color indicates the occurrence of differences between the samples at $p \leq 0.05$. Tukey test was carried for multiple comparisons between the averages. The values exhibiting the same letters do not present significant difference between them at 5% of significance.

Table 3. Tukey test results are presented on Table 03 for each studied parameter during the maturation period

Days	color				
19	8.22	a			
17	7.85	a			initial level
15	7.54	a			
12	6.67	a	b		intermediate level I
10	5.55		b		
8	3.86			c	intermediate level II
5	2.03			c	d
1	1.50				d final level
3	1.33				d

Sensorial color determination did not present significant difference ($p \leq 0.05$) between the days 1, 3 and 5; 5 and 8; 10 and 12; and 12, 15, 17 and 19, however differences were noted between these groups. The fruits showed moderated characteristic colors between the 10th and 12th day and very characteristic colors from the 12th.

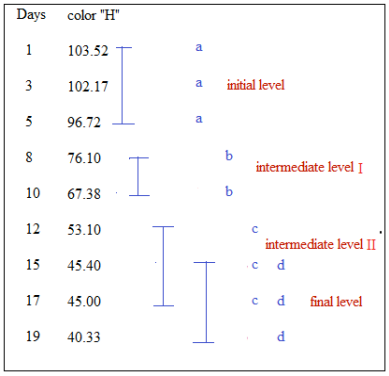
Table 4. Tukey test results for color "a" during the maturation period.

Days	color "a"				
19	20.03	a			final level
17	17.96	a	b		
15	16.24	a	b		intermediate level I
12	15.11		b		
10	7.98			c	intermediate level II
8	6.06			c	
5	-2.98				d
1	-4.54				d initial level
3	-5.11				d

The fruits included in the same maturation level did not show significant ($p \leq 0.05$) for the parameter "a", i.e., green – red color. Encountered maturation levels were composed of the days 19, 17 and 15; 17, 15 and 12; 10 and 8; 5, 3 and 1, however significant difference ($p \leq 0.05$) between the groups did occur, but with some similarities between the last two groups.

Parameter "c" for color, reveals the chromaticity of the tomato samples during maturation. Significant difference ($p \leq 0.05$) was not noted between the days 19, 17, 15, 12 and 10; 17, 15, 10 and 8; 10, 8, 5, 3 and 1. These results also show some similarities between the three maturation levels with increasing chromaticity from the 17th maturation day on.

Table 5. Tukey test results for color "H" during maturation period



The "H" parameter for color characterizes the fruit tonality during the maturation period and significant difference ($p \leq 0.05$) between the days 1, 3 and 5; 8 and 10; 12, 15 and 17 and 15, 17 and 19 were noted, but differences occurred between these groups. These results reveal four levels of tonality decrease during maturation period. The two last maturation levels presented some chromaticity similarities in the transition and lower chromaticity from the 17th of maturation.

The "ΔE" parameter represents the total fruit color variation during the maturation period. Tukey test results for color "L" during maturation period. No significant differences ($p \leq 0.05$) were noted during the maturation, excepting in the 8th and in the last five days of maturation. It means that the parameter under consideration cannot be taken into account as an important parameter.

Parameter "L" reveals fruit luminosity during the maturation period. Luminosity did not present significant difference ($p \leq 0.05$) between the days of 1, 3, 5 and 8; 5, 8 and 10; 8,10 and 12; and 10, 12, 15, 17 and 19.

Results indicate that fruit luminosity did not show any differences in the five first days. After the 10th day of maturation significant differences between fruits reffering to luminosity.

Three luminosity levels have been noted, in which the most intense occurred in the first day of maturation. Luminosity exhibits decaying and not well differentiable levels.

As reported by Borguini, R. G.; Silva, M.V. (2005), according to the above presented classification, as the fruit presents a higher chroma which occurs after the 15th maturation day, the analyzed fruits were noted to be in the initial chromaticity level and no differences were found between the Carmen and Debora cultivars. Raffo et al. evaluated cereja tomato type, Maomi F1 cultivar growing in green houses in Italy, obtaining a chroma value of 15.6.

4 Conclusions

Based on what it has been exposed before it can be concluded that it was possible to determine the parameter color for tomatoes of " Santa Clara" I5000 variety by means of sensorial, as well as instrumented analysis. Both methods generated reliable results as well as a statistically interpreted maturation level. The chromaticity between red and green colors, i.e. the color "a" and the color "H', i.e. the tonality, are the parameters which present the best well defined color as function maturation time.

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Metal Accumulation and Biomarker Responses of Odanata Larvae, *Ischnura elegans* (Vander Linden, 1820) Exposed in a Lead-Zinc Mining Area in Turkey

Kahraman Selvi[1], Hasan Kaya[2], Mehmet Akbulut[3], Alkan Öztekin[4], Fikret Çakır[5]

[1]Yenice Technical Vocational College, Çanakkale Onsekiz Mart University, Çanakkale, Turkey, e-mail: kahramanselvi@comu.edu.tr
[2]Marine Science and Technology Faculty, Çanakkale Onsekiz Mart University, Çanakkale, Turkey, e-mail: hasankaya@comu.edu.tr
[3]Marine Science and Technology Faculty, Çanakkale Onsekiz Mart University, Çanakkale, Turkey, e-mail: mehakbulut@comu.edu.tr
[4]Marine Science and Technology Faculty, Çanakkale Onsekiz Mart University, Çanakkale, Turkey, e-mail: alkanoztekin@comu.edu.tr
[5]Marine Science and Technology Faculty, Çanakkale Onsekiz Mart University, Çanakkale, Turkey, e-mail: fikretcakir17@yahoo.com

Abstract. This study was conducted in September 2014 to determine the effects of metal accumulation on the Odanata larvae which is a freshwater macro-invertebrate. Polluted area in the lower part of the mine founded on Umurbey Stream (Çanakkale, Turkey) and unpolluted area in the upper part of it are defined as the sampling stations. In this study, GSH (Glutathione), TBARS levels and Na^+, K^+ -ATPase activity were measured after the determination of metal accumulation (Cd, Cu, Fe, Pb, Zn) in the water and in the Odanata larvae, *Ischnura elegans* (Vander Linden, 1820). There was a decrease in Na^+, K^+ -ATPase activity; although the increase in GSH and TBARS levels in organisms sampled from polluted area. These results indicate that; metal accumulation caused to oxidative stress in Odanata larvae *I. elegans* and this organism reacted by running the compensate mechanisms for it.

Keywords: Metal accumulation, Biomarkers, Oxidative stress, Umurbey Stream, Odanata, *Ischnura elegans*

1 Introduction

Aquatic resources are gradually polluted by the natural and anthropogenic effects, day by day. Metals are one of the most important reasons of inorganic pollution in aquatic environments (Selvi, 2015). Metals which are discharged to aquatic ecosystem do not only dissolve in water, also accumulate in the food chain by taking aquatic organisms or sink to the bottom depending on the environmental conditions (Rainbow, 2002).

Benthic macro-invertebrates as Odanata larvae play a major role in ecosystems and take up the metals in different stages of the food chain (the food cycles,

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decomposition and production) -whether essential or not- from water, sediments and foods (Rainbow and Wang, 2001). By accumulating within the tissue of such organisms; metals may lead to irreversible and adverse changes in later stages in molecular level. Many chemical pollutants such as heavy metals cause the production of reactive oxygen species (ROS) which in turn result in oxidative stress (Stohs and Bagghi, 1995).

Umurbey Stream passes and located on the northeast of Çanakkale, is fertile for lead and zinc; it would be metal discharges into water from the rocks. So it causes deterioration of water quality and accumulation of metal in macro-invertebrates. In terms of assessing the ecological status of the river ecosystem of Umurbey Stream; there is no study that examines the effects of the pollution on the invertebrate physiology as well as the accumulation of the heavy metals available. In this study, the physiological effects of the metal pollution in Umurbey Stream, resulted from the Pb-Zn mine, established in the location, on macro invertebrates (*Ischnura elegans* Vander Linden, 1820) were analyzed by using biomarkers. For this purpose; the analyses of the physico–chemical parameters of the water, analyses of the heavy metals in water and invertebrate tissue and the biomarker analysis in the tissue were conducted.

2 Material and Methods

Umurbey is a stream which varies flow rate and water carrying capacity depending on the seasons, arises from the Koru Mountain that is located within the boundaries of Umurbey town (Çanakkale) and flows into the Dardanelles. However, there is a mine founded on Umurbey Stream (Çanakkale, Turkey) to obtain lead and zinc by utilizing this water resource.

Water samples and Odanata larvae were collected from the lower part (polluted area) and the upper part (unpolluted area) of the mine in September, 2014. The locations of the sampling sites are shown in Figure 1.

2.1 Physico-Chemical Analysis

The temperature (T), pH, electrical conductivity (EC), salinity (S) and dissolved oxygen (DO) of each water sample were measured at the sampling points by a pH meter and oxygen meter, respectively.

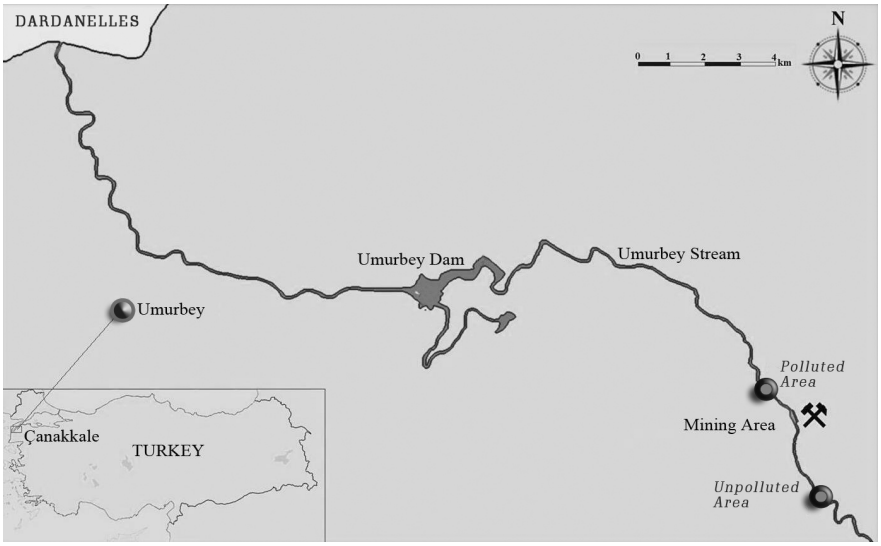

Fig. 1. Sampling Stations on Umurbey Stream

2.2 Metal Analysis in Water and Organisms

Water samples taken from the stations were filtered PTFE (0.45 mm pore size) for metal analysis and they were determined from ICP-OES Varian Liberty Sequential. However, the organisms were dried at the incubator set to 70°C for 24 hours after measuring the wet weight. Subsequently, dry weights of samples were weighted. Then, samples were burned over a hot-plate set to 70°C for an hour, following the addition of 5 ml HNO_3. After the samples were burned homogenously and cooled, they were filtered in a 0.45 μm syringe and diluted to 20 ml with distilled water (Smith et al., 2007). The metal analyses in organisms were determined with ICP-OES Varian Liberty Sequential.

2.3 Biomarker Analysis

Total glutathione (GSH) was determined according to Owens and Belcher (1965) method. Shortly, 40 μl homogenate, blank or standard, was added in triplicate to a microplate well containing 20μl of DTNB, 260 of assay buffer (K_2HPO_4, EDTA, pH7.5), and 20μl of glutathione reductase. Their action was started by the addition of 20μl of NADPH, with changes in absorbance at 412 nm (Thermo Multiscan FC, microplate reader) recorded over 10 min, and total GSH (μmol g^{-1} wet weight tissue) determined using the standard calibration curve (Smith et al., 2007).

Thiobarbituric Acid Reactive Substances (TBARS) assay was performed according to Camejo et al. (1998). Shortly, samples were defrosted and homogenized (Stuart SHM1, Homogenisator) in 5 volumes of buffer (Sucrose, EDTA, Hepes, adjusted to pH 7.4 with 20 mM Tris). Then 200 μL of homogenate was added to a

well of a 96-well microplate containing phosphate buffer. Following this, TCA and thiobarbituric acid were added, the plate was incubated at 60°C (1 hour) and then cooled on ice. Absorbances were recorded (in triplicate) at 530 nm in the microplate reader (Thermo Multiscan FC, microplate reader). All data from the assays were calculated per mg of cell protein. Protein was determined in 20 μL of each homogenate (in triplicate) according to Bradford, 1976. Samples were read at 595 nm (Optizen spectrophotometer) against to standards of bovine serum albumin (Bouskill et al., 2006).

Na^+, K^+-ATPase activity was determined in raw tissue homogenates Silva et al. (1977). Shortly, samples were defrosted and homogenized (Stuart SHM1, Homogenisator) in 5 volumes of buffer (Sucrose, EDTA, Hepes, adjusted to pH 7.4 with 20 mM Tris). Homogenates was added to a K^+ containing medium, while a second homogenate aliquot (0,4 mL) was added to a second K^+ free medium. After incubation (37°C for 10 min), there actions were stopped (with using 1 mL TCA), free phosphate was measured by adding 1 mL freshly prepared color reagent ($FeSO_4.6H_2O$, ammonium heptamolybdate), and absorbances were measured at 660 nm (Optizen, spectrophotometer) against phosphate standards (Bouskill et al., 2006).

2.4 Statistical Analysis

The data obtained from biomarker and metal analyses of Odanata were subjected to t-test by using the Minitab-User Guide program. In these statistical comparisons, a value of $p<0.05$ (95% Confidence Interval) was considered significant (Anonymous, 1996).

3 Results and Discussion

In this study, metal concentrations, GSH, TBARS levels and Na^+, K^+ -ATPase activities were examined in Odanata larvae sampled from Umurbey Stream. Water quality parameters, their units are summarized in Table 1. Furthermore, the results of metal levels and biomarkers responses in organisms are given in Fig 2 and Fig 3, respectively.

Metal accumulation in Odanata larvae sampled from the polluted area was measured higher levels, depending on the metal concentration in water. Odonata larvae need water with plenty oxygen and constant flow as they spend their growth period in water (Mandaville, 1999).

Depending on the mining activities; levels of all metals measured in Odanat larvae sampled from polluted area are determined higher than unpolluted area; and the differences were identified statistically significant ($p<0.05$). The metal which is uptaken by macro-invertebrates with different ways (water, sediment and foods); immediately excreted from their bodies or detoxified, if is not suitable for their metabolic activity. Besides, if the percentage of uptaking metals is higher than the percentage of excreting and detoxifying, non-essential metals accumulate in their bodies and also the toxicity occurs (Rainbow and Luoma, 2011).

Table 1. The results of physico-chemical parameters and metal concentrations of surface water sampled from Umurbey Stream

Data	Unit	Unpolluted Area	Polluted Area
T	ºC	13.44±0.02	14.57±0.14
S	ppt	0.24±0.02	0.31±0.02
pH	pH	7.52±0.01	7.24±0.03
EC	μS cm^{-1}	229.53±2.26	247.68±4.46
DO	mg L^{-1}	8.82±0.04	7.04±0.11
Cd	mg L^{-1}	n.d.	0.02±0.01
Cu	mg L^{-1}	0.04±0.01	0.11±0.01
Fe	mg L^{-1}	1.21±0.08	2.13±0.04
Pb	mg L^{-1}	0.39±0.04	0.84±0.07
Zn	mg L^{-1}	0.62±0.05	1.61±0.09

In this study, in parallel to the increase of the heavy metal levels in the water and the invertebrate species in Umurbey Stream; it was observed that the GSH, which forms up a significant part of the antioxidant defense system, increased due to the rise of the production of ROS. Also the differences between the stations were found to be significant ($p<0.05$). In similar studies, conducted on macro invertebrates, it was also reported that the enzyme activates were affected by the pollutants and such pollutants caused oxidative stress and led to changes in anti-oxidant enzyme activities (Parkes et al., 1993; Sivori et al., 1997; Kaya, 2014).

In the study, depending on the pollution, it was measured in TBARS levels of organisms. Moreover was determined to be significant differences between the stations. The increases on TBARS levels of the Odanat larvae, collected in polluted area from Umurbey Stream, can be interpreted as an onset of lipid – peroxydation. The oxidative stress increases the free oxygen radicals or disrupts the antioxidant defense mechanisms. The antioxidants, affected by the oxidative stress, either by being stimulated or being inhibited, may lose their ability to prevent the formation of ROS or to prevent cell damages (Kavitha and Rao, 2009). The metal water pollution being excessive in this region of river ecosystem, which is under the threat of pollution and the excessive metal accumulation in live organisms are the reasons of the formation of lipid – peroxydation. In many studies (Di Giulio et al., 1993; Livingstone et al., 2003; Barata et al., 2005; Kaya, 2014), it has been reported that enhanced lipid peroxidation in aquatic organisms exposed to high concentrations pollutants.

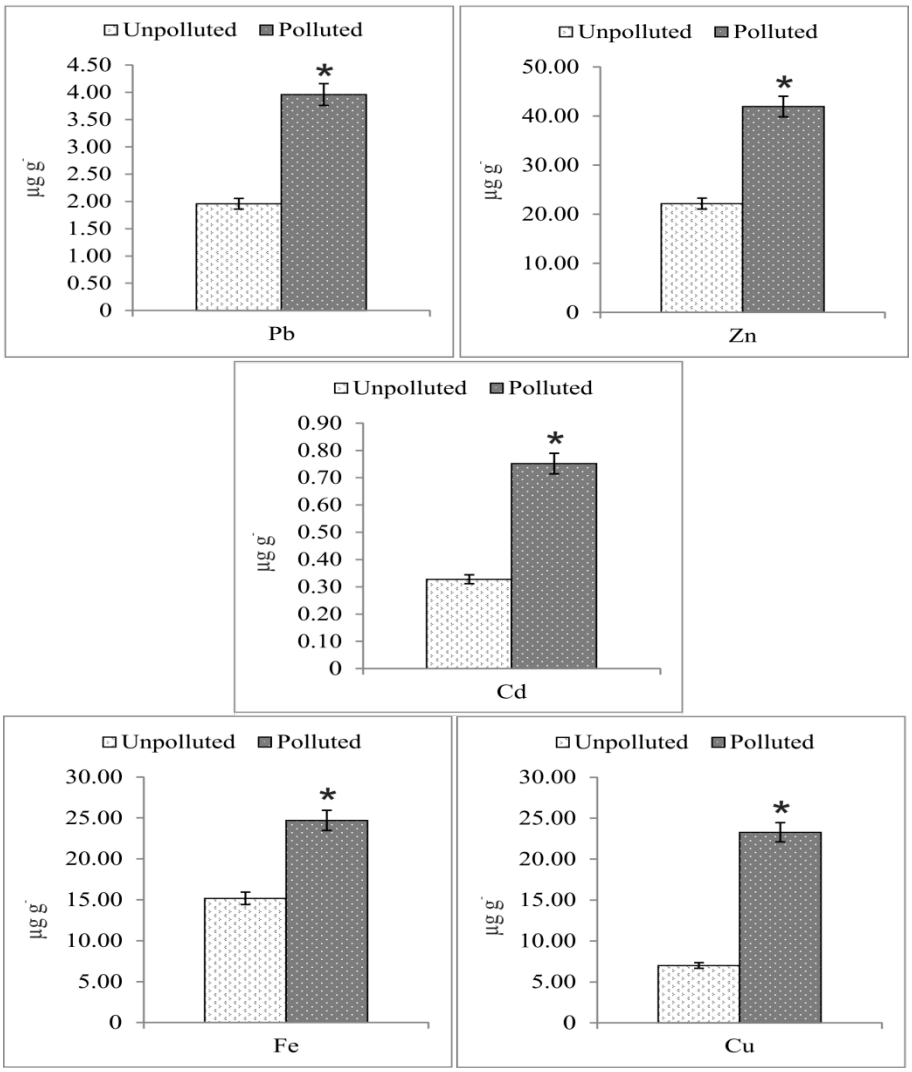

Fig. 2. Heavy metal bioaccumulation parameters of *Ishnura elegans* collected from Umurbey Stream in September 2014 (Value along a column with (*) was significantly different from other values in column; * $p<0.05$).

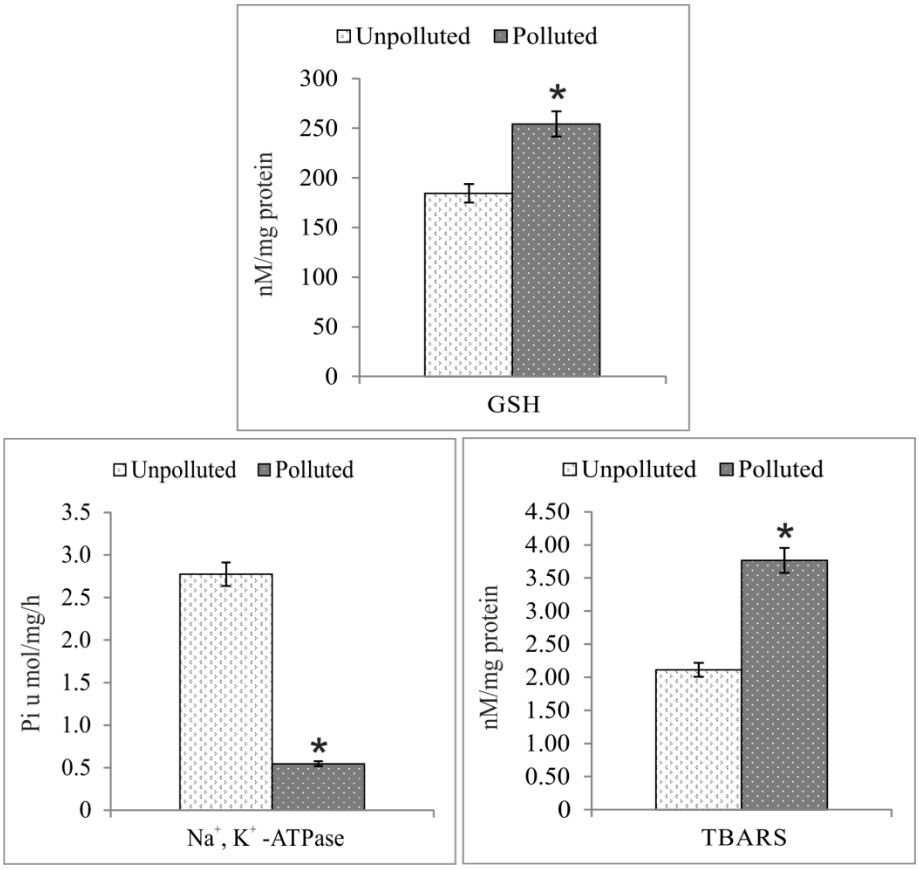

Fig. 3. GSH, Na^+, K^+-ATPase activity and TBARS levels of *Ishnura elegans* collected from Umurbey Stream in September 2014 (Value along a column with (*) was significantly different from other values in column; * $p<0.05$).

Na^+, K^+-ATPase enzyme activity in Odanata larvae *I. elegans* collected from the polluted area was found to be considerably inhibited. It could be interpreted as the running compensation mechanisms to return to control levels of the enzyme (Stagg and Shuttleworth, 1982). The major functions in excretion and osmoregulation of Na^+, K^+-ATPase in aquatic macro-invertebrates have been reported by several researchers (Peacock, 1981; Nicolson, 1993).

Many organisms, by their antioxidant defense systems, detoxification mechanisms and their ability to preserve the oxidant – antioxidant balance, have developed a basic cellular defense system. Since the enzyme activities are the first response to the environmental stress conditions; they are considered as the fastest markers (Depledge and Fossi, 1994). Livingstone (2001) has been reported that there was a significant correlation between free radical processes and antioxidant defense system in the toxicity of organisms.

These results indicated that combination of chemical and biochemical responses can be used to assess and specify the pollution in high stressed river ecosystems. Umurbey Stream has a great importance for fisheries and agricultural activities. Lots of vegetables and fruits are irrigated from this water supply. Therefore, to keep the pollution levels of stream under control is important for sustainability of the ecosystem. Besides, it is suggested monitoring studies depending on the seasons and other parts of the streams; by considering that pollution effects may vary with the parameters of water (pH, salinity, temperature) in subsequent research.

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An Innovative Sensor in the Agro-food Supply Chain: a RFID Technology Model

Francesco Contò[1], Nicola Faccilongo[1], Raffaele Dicecca[1], Claudio Zaza[1], Piermichele La Sala[1]

[1]Department of Economics University of Foggia, Largo papa Giovanni Paolo II 1, Foggia 71100, Italy

Abstract. This paper explores an opportunity for technology transfer monitoring and control, based on the use of miniaturized, smart and innovative sensors able to follow the product and guarantee the quality during all stages of the agro-food sector. The information concerning to the state of the product is transferred in real time in a wireless way, according to the RFID technology. The aim is to improve the quality and the logistics of the chain and offer therefore, environmentally friendly and cost-effective solutions to optimize production flows, by networking the existing Italian hubs. This opportunity also offers the chance to develop business ideas through which encourage settlement in the territory of new public and/or private subjects, able to offer goods and services with high technological content. Moreover, the paper aims to enhance the results of public research, through the diffusion and transfer of technologies to the productive system and the creation of high-tech enterprise.

Keywords: System of innovation, Agricultural technology, Agro-food quality and traceability, RFID Tag

1 Introduction

Policies to promote and encourage transfer of technology and innovation in the agricultural sector may take different shapes depending on both the specific target and strategies. Some may foster the creation of a community-supported network focus on how to improve the quality and the logistic of the chain and other stress efficiency of production functions of local food system. One of the main issues of the Italian system of knowledge and innovation in agriculture lies in the weak coordination among its components, particularly among development services and research. In this context, it is useful to promote policies aimed at: i) creating networks stressing multi-level stakeholders behaviors; ii) being able to facilitate the transfer of knowledge from research and agricultural innovation. Part of the needs that emerged from the development programs for Southern Italy (Mezzogiorno d'Italia) in Puglia and from the Rural Development Programs (RDP), highlight, indeed, their goals of competitiveness and sustainability of the agricultural, agro-industrial and rural sector. In this framework it might be productive to find a solution

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to optimize the agro-food supply chain through an innovative way to control the traceability of the product. The article makes use of a project useful as an example of innovative process that put the most modern information and communication technologies (for other IT innovation in agrofood sector, see also Contó et al., 2015) at the service of knowledge produced and its use. The project, which involves the use of RFID technology (Radio Frequency Identification), builds a public-private partnership composed by local institutions and various actors involved in the generation, dissemination and adoption of knowledge in the agricultural sector. Researchers, development services technicians and, through these, agricultural enterprises, have been so included in a network that aims to meet the demand for innovation and the supply of research to address specific needs of the apulian agro-food chain. After a brief literature on the system of innovation and the innovation processes, the paper provides insights about an innovative sensor based on RFID technology for the certification and food safety. Finally, it defines the role of CESAR research project, as useful tool to promote the diffusion of innovation and knowledge to boost the apulian agricultural sector. Conclusions are drawn. This work can be considered a working in progress, an attempt to propose a concrete way to foster innovation and technology transfer in the agro-food sector.

2 The System of Innovation and Innovation Process: the General Framework

Innovation is one of the key strategies proposed in the literature and economic government policies as a crucial driver of the agro-food sector. Innovation, especially in the agricultural sector, is not manifested only as adoption of new technologies, but also requires a balance between new practices, techniques and alternative ways to organize and manage: markets, labor, land tenure, distribution of benefits, etc. An innovation system is a network of organizations, companies and individuals with the aim of bringing to market new products, new processes and new forms of organization, together with the government institutions and policies that influence the methods of action of the different agents the supply chain (World Bank, 2006). Beyond researchers, extension agents and farmers, an agricultural innovation system consists of all types of public, private and civil society actors, such as inputs and processing industry actors, agricultural traders, retailers, policymakers, consumers and NGOs. The system approach recognizes the influential role of institutions (i.e. laws, regulations, attitudes, habits, practices, incentives) in shaping how actors interact (World Bank, 2006). Innovation can't be seen as a linear approach to innovation in which public sector agricultural research delivers new technology through a dissemination approach, but calls for systems approach in which innovation is the result of a process of networking, interactive learning and negotiation among a heterogeneous set of actors (Leeuwis, 2004; Röling, 2009).

The European Commission in its Europe 2020 Strategy (European Commission, 2010), places innovation and research at the center of attention for face future challenges. The orientations for the "CAP towards 2020" (European Commission, 2010) underlines the role of innovation as being a main leader in the European Union

agriculture in the coming years. Analysis of systems of innovation (Freeman, 1995; Lundvall, 1992; Nelson, 1993; Arundel and Geuna, 2004; Edquist and Johnson, 1997; Breschi and Malerba 1997), innovation and scientific networks (Freeman, 1991; Callon, 1994; Hohn and Lutz, 1994), triple helix model (Etzkowitz and Leydesdorff, 1997, 2000; Leydesdorff and Etzkowitz, 1998) and the innovation becoming more open or distributed over time (Coombs et al., 2003), in turn associated with increasing levels of collaboration and outsourcing (Chatterjee, 1996; Howells, 1999a), has led the analysis to investigate more closely the role of the nodes and links in this process (Howells, 2006). It has been applied in other sectors, mainly in industry. The concept is considered to have great potential to add value to previous concepts of agricultural research systems and growth by drawing attention to the totality of actors needed for innovation and growth, consolidating the role of the private sector and the importance of interactions within a sector, and emphasizing the outcomes of technology and knowledge generation and adoption rather than the strengthening of research systems and their outputs (World Bank, 2006). This central role of research and innovation is developed further in one of the seven EU 2020 flagship initiative "Innovation Union" (European Commission, 2010) which introduces the concept of European Innovation Partnerships (EIP) as a new way to foster innovation.

The EIP aim to foster a competitive and sustainable agriculture and forestry that achieves more from less' and works in harmony with the environment (Contò et al., 2012); help building a competitive primary sector that secures global food availability, diversified products and production, long-term supply of various raw-materials for food and non-food uses, as well as a better allocation of added value across the food chain. Under these conditions, the EIP identifies two main objectives: as an indicator to promote the productivity and efficiency of the agricultural sector, it aims to reverse by 2020 the recent downward trend in the increase of productivity; and as an indicator of sustainability of agriculture, it aims to ensure the achievement of a satisfactory level of functionality of soils in Europe by 2020.

Regarding the transfer innovation in agricultural practices, the EIP make use of a number of existing policies: the Common Agricultural Policy (CAP) rural development policy in the field of Union research and innovation, to finance innovative actions concrete; the Rural Development Programs (RDP) are implemented generally within the strict boundaries of the regions covered by the program, especially at the local, regional or national, innovative actions at the interregional level, cross-border, and must be co-financed by the Union policy in the area of research and innovation. Synergies are sought with the opportunities offered by cohesion policy, in particular through regional strategies for innovation and transnational and interregional cooperation programmes (Materia, 2012).

Others key concepts related to the innovation as system and diffusion of knowledge, can be find on social dynamics and the so-called open innovation. In line with the communication of the European Commission, the rural sectors in Europe call for a review of the links between knowledge production and its use to foster innovation. The new agricultural knowledge and innovation system (AKIS) must adapt to the emerging economic, social and environmental challenges by making the best use of diversity in technologies and innovations that can achieve more with less while respecting the environment. Social innovation stresses the need for social and

political changes in the context of rural development and producer-consumer relationships. Social innovation includes collective and creative learning processes, in which actors form different social groups and rural and urban contexts participate (European Commission, 2013). Together they develop new skills, products and/or practices, as well as new attitudes and values that make a difference in addressing the sustainability challenge in rural societies. The necessary skills, moreover, to achieve new forms of competitive advantage for small and medium-sized enterprises (SMEs) in the agro-food sector as "dynamic capabilities" emphasizing the key role of strategic management in appropriately adapting and integrating internal and external organizational skills, resources and functional competences to match the requirements of a changing environment (Teece et al., 1997). The role assigned to the social innovation passed thus through the concept of open innovation and its relation with the competitive advantage for the SMEs. The theory of Open Innovation and the business model that derives from it, are particularly adaptable to the configuration management of SMEs. Many smaller companies manage to be innovative only in the moment in which they are able to define, support and give continuity to its competitive advantage. Nevertheless, the likelihood of such optimal conditions is reduced to the high level of risk related to innovation, the high degree of uncertainty about the possible economic returns, the lack of a coherent model of innovation management (Cooper et al., 2005). We must, however, emphasize that economic conditions are forcing even the most entrepreneurial "closed" to consider the possibility to go beyond their boundaries and explore the outside world. Faced with this situation, recent studies in the field of innovation and technology management, explained the potential benefits related to an innovative process of opening to the outside (Gassman, 2006), usually characterized by reduced bureaucracy and greater inclination to risk by administrators, possession of highly specialized knowledge, increased ability to react to rapid changes in the market (Christensen et al., 2005). In SMEs, even more than in the large corporates, being innovative means knowing how to better manage their "strength" competitive. From this point of view, the rapid changes in technology are certainly not helpful, because induce small businesses to activate processes of product development in an ever more quickly and efficiently manner. This, in some ways, could result in enormous sacrifices but, arriving before the direct competitors, would mean obtain innovative and cost effective advantages. One way to stimulate this new evolutionary process consists in emphasizing links with actors in the micro and macro business environment, thus creating that knowledge system useful to acquire the dynamic capabilities to meet the challenges that agricultural companies have to face.

Next section, then, will focus on the way in which we can apply such innovation system models, analyzing how to develop innovative ideas using the most recent information and communication technologies.

3 An Innovative Sensor in the Agro-food Supply chain: a RFID Technology Model

3.1 Quality and Traceability of food product

As mentioned before, it is useful to promote policies aimed at creating networks stressing multi-level stakeholders behaviors, able to facilitate the transfer of knowledge from research and agricultural innovation. With this aim has been achieved the CESAR project (Certification and Food Safety by RFID), still in early stages, in the Apulia region, an attempt to bring together the efforts to create a network that involutes public and private institutions to promote transfer of technology. For farms participating in the project represents an opportunity offered totally free, to test a system of transfer of technology for monitoring and control, based on the use of miniaturized sensors and intelligent able to follow the product and guarantee its quality, during all stages of the food chain. The quality and food safety are parameters that accompany the whole life of the product, since the primary production, in all stages of processing, storage and packaging. In these stages (post-harvest or post-production) is more critical to perform controls due to the risk of a deterioration which affects the work done upstream and degrades a product which initially was of high quality. Keep under control and continuously monitor certain parameters essential for the quality of the product is an activity which, however, still today, is not carried out in a totally efficient manner. The current procedures provide, in fact, to set the best conditions for the processing and to perform a test on individual lots, but this system does not provide the certainty that uncontrolled lots are in accordance. The potential economic saving should not be underestimated because sometimes the individual lots are so broad as to cover a working day or a whole order of the customer. To reach this goal is necessary to move completely the way to manage the traceability of the product: not affects only the origin of it but involves detailed information on what happened at each stage of the life cycle, consistently and without interruption. Currently, the management systems of traceability and quality are concerned with collecting data at various stages of production, but these data are acquired in necessarily discontinuous procedures and grouped in batches. In other words the data available are restricted to individual production lots which represent quantities far greater than those refer to the individual production units. The quality is seen as the average value of more detections, in the best of cases, or as the single value of the significant sample on which are performed the analysis. There is no way to know what happens at the level of single production unit. The information is then distributed and not centralized and "follows" the product along the way acquiring and transmitting the parameters that identify the preservation of quality. System developed in turn provides a system of checks distributed and will be responsible for read the information collected and continuously detect the value of the individual parameters, allowing, appropriate steps to verify if they comply with the directions of the production rules. This allows

to assess whether conditions that occurred, have altered the quality of the product, including expense of food security.

3.2 RFID model

Briefly, in this session we describe the functioning of the technology. The information relating to the state of the product is transferred in real time in a wireless manner, according to the RFID technology. RFID technologies, thanks to the possibility of monitoring and tracking deals, are suitable for applications increasingly widespread within the various food chains, especially to uniquely identify the products and reconstruct the history along the chains. The RFID systems, compared to those more established as the barcode, offer additional benefits such as greater number of storable information, the presence of unique identifiers and irreproducible, a greater reliability of reading and the possibility of storing information in either a centralized, in a database, and decentralized way directly to each product. The sensors are in the network and communicate the data in a wireless manner using RFID technique that allows the transmission in two different ways.

First mode involves querying the sensor to pass through special gates, with readers and places corresponding to certain stages of production (at the entrance of the storage area, at the entrance of cold storage, at the beginning of line processing, packaging, shipping, etc.). The second mode provides for the spontaneous transmission by the sensor when one of the detected parameters, which proves to be particularly critical, exceed certain threshold values. In this phase, the sensor sends a signal to indicate that the product is at an early stage of degradation and action must be taken promptly.

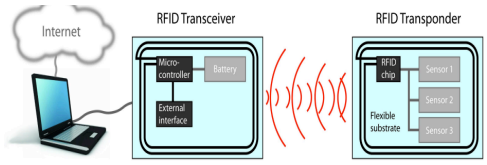

Fig. 1. RFID technology. Source: our processing.

The last frontier in the field of RFID technology is the introduction of active tags equipped with sensors that can detect environmental parameters (temperature, pressure, humidity, gas) where the products subject to control, they are immersed. The values measured by the sensors are stored in a special internal memory, and remain there until an operator equipped with card reader, do not run the exhaust on a Handheld PC. This is of strategic importance for the monitoring of organoleptic parameters of food and perishables in general, where it is necessary to ensure operational regimes controlled. The tags, because of the small size, can be placed in "uncomfortable" points, where it would be difficult to bring a card and a cable access needed to fuel a measuring device, and offer much content costs, a reliable solution and easy to implementation. Thanks to the use of such solutions can monitor the state of conservation of a substance, or report an alarm when the temperature parameter is not in the desired range, without opening the packages that protect the substance stored in temperature and managing the data in a data processing, from a central site,

where to take the appropriate decisions: delete the product or accelerate the treatment of a process. The software platform, by interfacing with the appropriate RFID detectors, will deal with the acquisition of the data collected by the sensors and processing them in order to ensure the constant monitoring of the products during each phase of the production cycle. In each phase, the system will be able to determine the condition of the product and to promptly identify the conditions that may lead to a degradation with consequent reduction of the quality and healthiness. In this stage is important to disclose the technology which in fact consists of a platform integrated and configurable able to adapt to the specificity of each individual production, both within the same chain, either of different sectors. The technology therefore consists in a system of distributed monitoring of perishable food products through the use of intelligent micro sensors placed on the individual units of product. The system consists, briefly, of two basic elements: a network of distributed sensors and a software platform for the collection and analysis of data and may also be implemented in an integrated form (RFID tags) for the monitoring of the individual products and as Mini-Card (black box) for the monitoring of batches. In the first case the chip (RFID tag) is integrated in the package and intended to be thrown away with the packaging when having assumed his job during the life of the product on the shelf or shelf distributor; in the second case the black box will follow the life of the batch of product and will be destined to be reconfigured and reused over time.

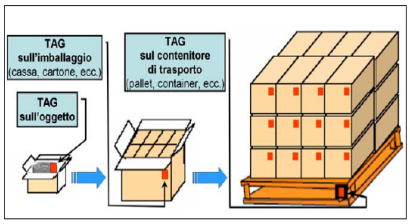

Fig. 2. Tag's positions. Source: our processing

4 The CESAR project and the public-private Partnership

The aim of the RFID model is to improve the quality and supply chain logistics and propose therefore, environmentally friendly and cost-effective solutions to optimize production flows, networking italians hubs already exist and so favoring the process of internationalization of local companies. This opportunity also offers the chance to develop business ideas through which encourage settlement in the territory of new public and/or private individuals, able to offer goods and services with high technological content. The implementation of the concepts expressed above and the adaptation of the methodology to the specific case, is the result of the "Associazione temporanea di scopo -ATS" (Syndacate association on a temporary basis), who presented the CESAR project. The CESAR project (Certification and Food Safety by RFID) identifies the research project presented in the spring of 2012 to the italian Ministry of Economic Development. It consists on a public-private partnership

composed by the Polytechnic of Bari, Unione provinciale agricoltori (Provincial Union Farmers) Foggia, Confindustria Foggia, Agro-food Regional District (DARe) and the University of Bologna, in response to the program from the system for Technology Transfer Research to SMEs and the creation of new high-tech companies. The CESAR research project, still in an early stage, has a duration of 24 months. The main activities concern (i) the structured analysis of the connections between the supply of technologies and demand for innovation; (ii) the development of an innovation strategy geared to productive specialization and (iii) the needs of the SME market and the strengthening of a common culture of innovation in relation to the subsequent processes of technological spillover and start-up company.

Specifically, monitoring technology of perishable product and processing of data will be managed at the Polytechnic of Bari and at T3LAB (University of Bologna), experts in engineering and RFID technology; the presence of the other partner, DARe, Confindustria and Provincial Farmers Union Foggia, will overcome any difficulties in technology transfer in areas of the territory not informed of developments occurred in the field of quality control in the food chain using RFID techniques and more generally will address the dissemination of knowledge and intermediation between universities and farmers. For support, supervise and coordinate the activities that govern the transformation of research results into economic value, such as the protection and enhancement of the results found and the generation of innovative entrepreneurship, the partnership provided for the definition of specific actions.

Moreover, the activities can be summarized as follows: the study activity has declined in three logical functions. The function of knowledge mapping through which organize and manage data about the technologies. The function of innovation intelligence through which detect and correlate the need for innovation, the technological potential, the enablers and the value propositions of companies. The function of community building through which support the relations of exchange and mutual learning. These functions will be based on three other tasks:

1) structuring the portfolio of technologies and technology scouting activities. This activity aims on the one hand to develop a strategic review process technology offers, in order to compose a technology portfolio structured according to the innovative profile of protectable and market opportunities. On the other hand, consider the placement of technology both with respect to the characteristics of specific regional clusters of agribusinesses, and opposed to the larger technological scenarios for the sector, in order to create the appropriate conditions for subsequent technology transfer actions;

2) analysis of the innovation needs. This activity is designed to detect the needs of innovation coming from companies in the region through the analysis of key business needs, technological competence in terms of assets and know-how, resources and organizational capabilities. A clear and shared approach paves the way for the adoption of a dynamic orientation to the formulation of strategies aimed at overcoming the gaps of innovation;

3) establishing patterns of technology transfer. This activity aims to identify, analyze and select the most suitable models for technological transfer to the enhancement of the proposed technologies, depending on the characteristics of the technical-scientific (transdisciplinarity), the regime of appropriability of knowledge (replicability), the

nature and type of additional resources needed (absorption), the coordination and integration of the flow of knowledge and information (organization).

5 Discussion and Conclusions

The present paper intended to define a model of organization based on theories of system innovation and technology transfer, able to enhance the results of public research through the dissemination and transfer of technologies to the productive system and the creation of high-tech enterprise.

Especially in Puglia, the majority of small and medium enterprises in the agro-food sector feel as fundamental the satisfaction of the need for technological innovations that allow to improve food security and the health quality of their products, thus adapting to the constraints posed by food law, and eliminating or reducing the risk of poisoning, infection and disruption to consumers related to the presence of biological contaminants in food, chemical or physical. The ability to create a model that deals with traceability and certification of agro-food product based on RFID technology, would mean improve the quality and the logistics of the chain and offer therefore, environmentally friendly and cost-effective solutions to optimize production flows, by networking the existing Italian hubs.

The analysis carried out with the implementation of the CESAR project has strengthened the idea of the innovation system and technology development, involving public and private stakeholder of the territory. The project allows to: (i) analyze a structured connections between the supply of technology and demand for innovation; (ii) develop an innovation strategy oriented to productive specialization and to the needs of the SME market; (iii) strengthen a common culture of innovation according to the subsequent processes of technology spillover and start up business; (iv) disseminate information, prospects and opportunities resulting from research and experimental development; (v) ensure the active participation of the largest number of SMEs and the most relevant regional stakeholders operating in the agro-food sector; (vi) determine and assess the skills, processes and technology needs of a sample of SMEs, identifying strengths and weaknesses and (vii) explain the potential of technologies to be transferred demonstrating their actual applicability on a pilot scale. The paper used as a tool for technology transfer and innovation in agricultural sector, the Partnership presented within the CESAR research project allowing a strong link to territory and making possible the enhancement and the creation of high-tech enterprise in Puglia.

We conclude that the partnership represents an organization of public and private actors which is able to foster the implementation of the RFID model creating a system of technology transfer in the agricultural sector. We believe that the guiding principle of the actions promoted by the ATS lies in the awareness that a stronger relationship between the universities and the socio-economic context provides a solid basis for the exploitation of results and the strengthening of institutional relations and economic benefits in favor of the Apulian agro-food sector. We are aware that promote an effective dialogue between universities and industry, focusing on innovation and technology transfer, therefore means supporting businesses in the

difficult task of facing the challenge of competition relying on access to adequate levels of quality research and development.

For the future, the strategy to be adopted will therefore help to bridge the gap that still exists between research and the market in the innovation process. The exchange system is designed both to provide answers to specific questions, and to help qualify the same demand for innovation. The need for exploiting the results of research does not sit just downstream of their implementation, but encompasses the whole operating process, from decision making to scientific processes and institutional relations.

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A Satellite-based Automated System to Detect and Forecast Cloud Storms Focused on the Protection of the Greek Agricultural Sector

Stavros Kolios[1]

[1]Hellenic Agricultural Organization "DEMETER", Greece, e-mail: stavroskolios@yahoo.gr

Abstract. This study presents a fully automated system based on Meteosat multispectral imagery to detect and forecast cloud storms. The first accuracy assessment results are considered satisfactory, allowing this system to be able to operate in real-time basis and providing realistic and accurate forecasts for the storm activity as well as for dangerous phenomena accompany convective clouds like lightnings, hail and heavy precipitation. The presented system can operate in a more general point of view, as a driver in the adaptation of strategies and legislations that concern the crop productivity, reimbursements for crop losses, the sustainability of the environment and the improvement quality of lives through the efficient protection from storm effects and their impacts in the society.

Keywords: Storms, agricultural sector, automated system, satellite images.

1 Introduction

It is well known that the extreme weather phenomena (many of them are direct effects of the cloud storms) like heavy precipitation, hail, strong winds and lightnings can often cause disasters in infrastructure, private property and agricultural production. Therefore, automated systems that provide timely and accurate information to prevent and reduce disasters caused by such phenomena can be considered of major importance to the sustainable development of a region. More specifically, the majority of the cultivate areas is largely exposed to the weather conditions and often affected by extreme weather events although they comprise a key factor of economic growth. The agri-food sector (including beverages) accounts for 14.7 % of total EU manufacturing output, is the third largest employer in Europe and the second biggest exporter of foodstuffs globally. Moreover, according to the Hellenic agricultural organization “Demeter”, during the period 1990–2006 after the frost, hail and heavy precipitation were the most important weather phenomena for crop losses. Losses in crop production can significantly affect - among others - the commerce and the economy but the complex nature of extreme weather phenomena and the need for accurate and early warnings for possible extreme weather events,

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keep the weather forecasting among the challenging issues for the scientific community.

Especially in the last decade, an important contribution to the improvement in the weather detection and forecasting, comes from meteorological satellites. Multispectral images of high spatial and temporal resolution can be used nowadays in the operational forecasting and provide valuable information and timely warnings for the protection from the extreme weather events.

In this study, the main stages of the development as well as the first accuracy assessment results of a fully automated system to detect and forecast convective clouds (cloud areas that can evolve to storms and produce extreme weather conditions), are described. The system uses satellite images from the Meteosat multispectral imagery. The domain of the system includes the greater areas of Balkan as well as the central and eastern Mediterranean basin but is focused on the Greek periphery.

2 Data and Methods

2.1 Study Area

The domain of the system (Fig. 1) was choosen to include greater areas around Greece in order to eraly detect the existence of “signs” that can evolve to storms after after a few minutes (or hours).

Fig. 1. The red rectangle include the geographical domain of the system operation.

2.1 Data

There are five channels of the satellite instrument SEVIRI (Spinning Enhanced Visible and Infrared Imager) on board on Meteosat satellite platform that their images are used from the system (Table 1). At this point it is noteworthy to pointed out that there is an extensive use of these channels to detect and estimate precipitation and hail (e.g Simeonov and Georgiev, 2003; Lazri et al., 2014).

Table 1. Spectral characteristics of the Meteosat channels are used for the system.

Channel (Band)	Spectral region (μm)	Spectral center (μm)
5	5.35 - 7.15	6.2
6	6.85 - 7.85	7.3
7	8.3 - 9.1	8.7
9	9.8 - 11.8	10.8
10	11-13	12.0

2.2 Characteristics of the system

The system comprises an algorithm written in Visual Basic 2012 programming language. The system consists of two main modules, the detection module and the forecasting module. In the detection module, a set of criteria is used (Table 2) to detect all the cloud pixels belong to storms (or can evolve in the next minutes or hours to storms). Hereinafter, these pixels are referred as convective cloud pixels. These criteria comprise a combination well known and recent thresholding techniques for the detection of convective cloud patterns in the satellite imagery (Bedka, Mecicalski 2011; Merk and Zinner, 2013; Kolios and Stylios, 2014).

Table 2. The five citeria are used for the detection of the cloud pixels of interest in the Meteosat multispectral imagery.

Criteria
$T_{6.2\mu m} < 240$ K
$(\Delta T_{10.8\mu m}/\Delta T) < -6$ K $(15\ min)^{-1}$
$(\Delta T_{(6.2\mu m - 10.8\mu m)}/\Delta T) > 3$ K $(15\ min)^{-1}$
$\Delta T_{(6.2\mu m - 7.3\mu m)} > -20$ K
$\Delta T_{(12.0\mu m - 10.8\mu m)} > -3$ K

In the Fig. 2, it can be seen how the detection module of the system isolates the cloud pixels of interest (convective cloud pixels). The white colored areas refer to cloud areas. The whiter they are seen in the color composite of the Fig. 2, the most possible to evolve to cloud storm areas, are. All the pixels that fulfill the set of criteria of the Table 2, are stored in relative image files and in a central internal database of the system.

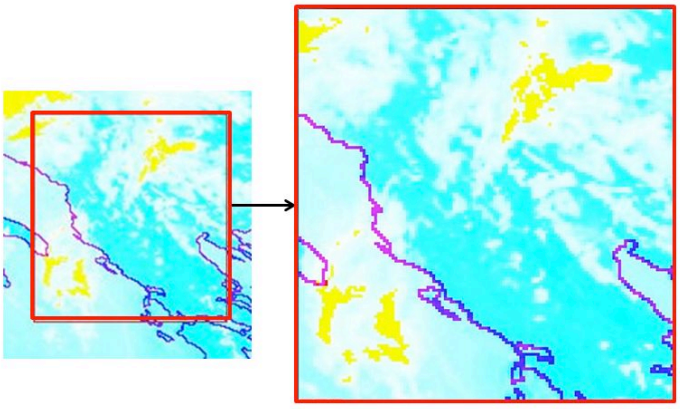

Fig. 2. Detection of pixels of interest from the system. On the left, the greater area of Greece can be seen. On the right, it can be seen, zoomed, the area inside the red rectangle of the left panel. The yellow colored pixels refer to the pixels of interest (convective cloud pixels).

For the accuracy assessment regarding the efficiency of the criteria in the detection of the convective cloud pixels, free datasets with lightnings from ZEUS system, were used (Chronis and Anagnostou, 2006). The lightnings are considered a good indicator for the detection of storm activity (e.g. Williams, 2005; Katsanos et al., 2006). For this reason, a spatiotemporal correlation between the available lightnings datasets and the relative satellite images, was conducted. More specifically, during a two-hour period, for every lightning event, the channel temperatures for the most relative pixel in time and space, was connected. As a result, it was collected a set of 3593 pixels with lightning events along with their relative temperature values in all the used channels. Considering that the lightnings are mainly located in cloud areas with intense storm activity, the threshold values were evaluated regarding their capability to isolate such cloud areas. In this first evaluation of the system detection procedure, three (out of five) criteria of the Table 2 were checked. The results show that there is a tendency for the pixels with lightnings to be connected with low temperatures in the 6.2 μm channel (Table 3 and Fig 3). There is also a second maximum in the distribution of the 6.2 μm channel (Fig. 3) that is connected with stratiform cloud regions where lightnings can also

occur. The same reason can explain the significant number of lightnings that not fulfill the "$\Delta T_{(6.2\mu m \text{ - } 7.3\mu m)}$" criterion. Conclusively, comparing the values of the distributions of the Fig. 3 along with their cumulative distributions, it is noted that at least the 50% of the total number of the pixels with lightnings, fulfill the threshold values of the relative parameter (Table 2). This result, highlight a satisfactory and efficient detection procedure for the convective cloud pixels.

Table 3. Basic statistics for the pixels with lightnings (K is "Kelvin" unit).**Error! Not a valid link.**

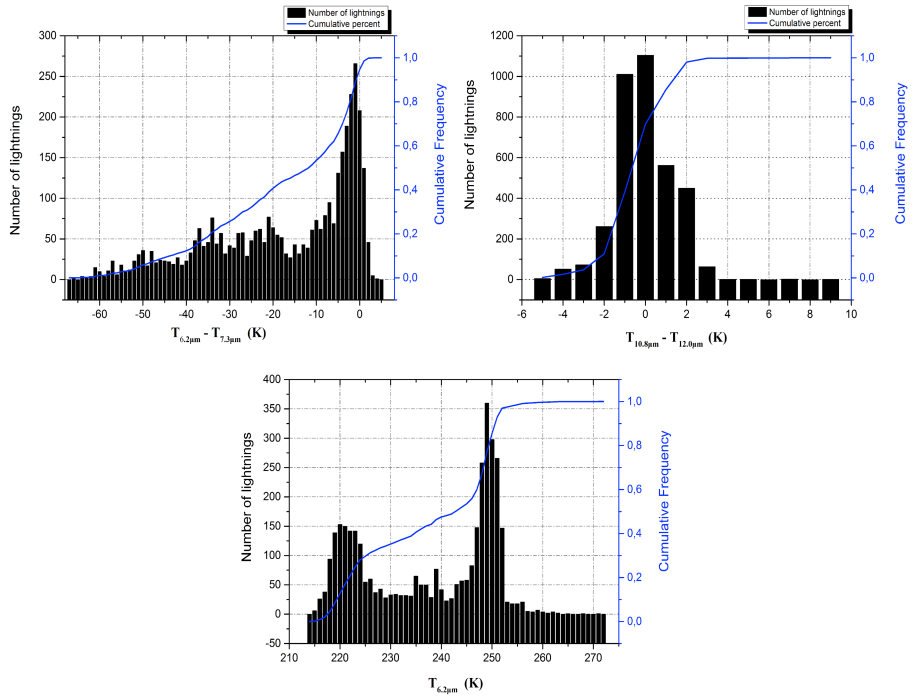

Fig. 3. Graphs that depict the distribution of the values for three parameters ($T_{(6.2\mu m \text{ - } 7.3\mu m)}$ above left, $T_{(10.8\mu m \text{ - } 12.0\mu m)}$ above right and $T_{6.2\mu m}$ down n the center) for the pixels with lightnings. The blue line represent the cumulative distribution (blue y-axis) and the black columns represent the number of lightnings pixels (black y-axis) for the different parameter values (x-axis).

The brightness temperature values, the channel differences and the cooling (warming) rates for all the pixels of the study area, are automatically calculated and stored in an internal database of the system. The forecasting methodology produces forecasts every 15 min and is based in linear multivariate functions (in its current version). More specifically, for a defined period, all the Meteosat images were selected and all the appropriate parameters were computed in order to construct the

analytical linear multivariate functions (regression analysis). These functions are referred to the temperature values of all the used Meteosat channels (Table 1). The dependent variable is the pixel temperature of a channel and the independent variables as well as their coefficients (Eq.1) is defined from the regression analysis and the evaluation results. Conclusively, there were developed five different analytical functions (for each of the channel temperatures). Each of them is used to forecast the relative channel temperature on a pixel basis. The coefficients of the functions are remaining constant in every forecast and the values of the independent variables are the relative mean values (estimates or observations) of the previous four timesteps (typical one hour before). For example, for the forecast one hour after the current time (t_o), the mean values (at pixel basis) from the three previous timesteps.

$$y = A_0+A_1x_1+\ldots..+A_nx_n \quad (\mathbf{1})$$

Where "y" is the dependent variable (pixel temperature of a specific channel), A_0 is a specific constant and A_n (n=1, 2, 3, …) is the coefficient of the relative independent variable x_n .

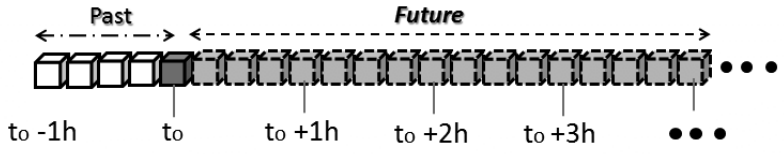

Fig. 4. Schematic diagram of the forecasting methodology of the system. Every cube represents a timestep of 15 min (same as the typical temporal resolution of Meteosat).

In the Table 4, basic statistics [Mean Absolute Error (MAE), Mean Error (ME) and correlation coefficient] of the forecasting procedure regarding the brightness temperature values of 6.2 μm channel in four different trimesters for a selected case study. The statistics were calculated using 603.841 pixel values. As initial time, the Meteosat image channels at 04:00 UTC (25/08/2006) were used.

Table 4.The accuracy of the forecasting procedure about the brightness temperature values of 6.2 μm channel in four different trimesters for a selected case study. As initial time, the Meteosat image channels at 04:00 UTC (25/08/2006) were used.

Forecast	MAE	ME	Adjusted R
15min	0.42	-0.013	0.99
30 min	0.59	0.0004	00.98
60 min	0.87	0.015	0.95
120 min	1.17	0.014	0.94
180 min	1.52	0.057	0.92

In the Table 4, it can be seen that there is a very small overestimation for the temperature pixel values in the 6.2 μm channel (the ME values are positive). The MAE is also very small in the first forecasting timesteps but it is gradually increasing for the next forecast and exceeds 1K after the first hour of the forecasts.

3 Conclusions

A fully automated system for the detection and forecast of the storms in the greater area of Greece was developed. The system is using image data from the operational meteorological European satellite, called “Meteosat”. This system can be established for operational use, having as basic scope the provision of accurate and timely warnings about extreme weather phenomena like hail, strong winds and heavy precipitation that can cause significant losses in the agricultural sector.

The first accuracy assessment results are satisfactory and the overall efficiency of the system for its potentially operational use seems promising for the protection of the agricultural sector.

Future steps include a more quantitative evaluation of the accuracy of the system and the use of nonlinear algorithms in an effort to be provided even more accurate predictions and the further extension of the forecasting capabilities, in time. A detailed digital maps with recent land use and land cover information are also intended to be integrated in the system, in order to provide more detailed warnings, aiming also to operate additional as an autonomous decision support system.

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Multi-species Cover Crop Biomass Evaluation Using a Hand-held Normalized Difference Vegetation Index (NDVI) Sensor and Photosynthetically Active Radiation (PAR) Sensor

Christos Vasilikiotis[1], Athanasios Gertsis[2], Konstantinos Zoukidis[2] and Ali Nasrallah[3]

[1]Department of Environmental Systems Management, Precision Agriculture Laboratory, Perrotis College, American Farm School, Thessaloniki, Greece, e-mail: cvasil@afs.edu.gr
[2]Department of Environmental Systems Management, Precision Agriculture Laboratory, Perrotis College, American Farm School, Thessaloniki, Greece
[3]Mediterranean Agronomic Institute of Chania (MAICh), Alsyllio Agrokepio, 1 Makedonias str. PO Box 85, Chania 73100, Crete, Greece

Abstract. Cover crops are essential in agricultural management and especially in organic farming for protecting the soil from erosion, competing with weeds, preventing evaporative losses and improving soil quality and fertility. The choice of cover crop species is crucial in achieving the highest level of weed suppression and soil fertility enhancement. Cover crop systems with rye or mixtures of legumes and grasses were set up in a randomized complete block design in Northern Greece. A hand held sensor was used to measure Normalized Difference Vegetation Index (NDVI) of the cover crop plots with parallel measurements of light interception with a PAR sensor, and destructive biomass determination. Weed biomass was also determined for each cover crop mixture. Multi-species cover crops produced higher total biomass than single-species cover crop systems. All cover crop systems evaluated were able to suppress weeds. Remote sensing results showed that NDVI could be used to estimate the total biomass of single cover crops but not cover crop mixtures.

Keywords: cover crops, biomass, weed suppression, NDVI (Normalized Difference Vegetation Index), light interception, PAR, organic agriculture.

1 Introduction

A key issue in organic agriculture is weed suppression to prevent competition with cultivated crops. The use of chemical herbicides is not allowed in organic agriculture, creating a great need to enlist cultural or mechanical methods to control weeds. Mechanical methods include plowing and frequent use of hoeing, disking, harrowing or cultivating (Liebman and Davis, 2009). Mechanical disturbance of the soil increases the risk of soil erosion and exposes lower soil layers to increased oxidation resulting in loss of CO_2 (Rodale Institute, 2012). Cultural weed control methods include intercropping, crop rotations and the use of cover crops (Liebman and Davis,

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2009). Cover crops are crops planted with the sole purpose of protecting the soil, competing with weeds and improving soil quality and fertility (Clark (ed.), 2007). Cover crops provide a wide range of benefits. They help reduce soil erosion, improve soil quality, control weeds, assist with biological control and enhance soil fertility (Dabney *et al*., 2001; Worsham, 1991). Single species or multi-species cover crop mixtures can be used depending on the agroecological zone and the type of farming system used (Wortman *et al*., 2012). The choice of cover crop species is crucial for the achieving the highest level of weed suppression and soil fertility enhancement. Multi-species cover crop mixtures containing both legume and grass cover crops have been shown to have increased productivity and resilience compared to single species cover crops (Wortman *et al*., 2012). This effect appears to depend on the type of cover crop mixtures used and the farming system and in some cases, no enhanced weed suppression or increased productivity of the subsequent crop was observed in multi-species cover crop mixtures when compared to single cover crops (Smith *et al*., 2014).

A cover crop trial was set up where individual species or multi-species cover crops were compared for their ability to suppress weeds and enhance soil fertility. The effect of each cover crop system on weed species was monitored and the biomass and diversity of weed species in each cover crop system was measured. To avoid the need to use destructive methods of biomass estimation, a hand held NDVI sensor was used. Remote sensing with NDVI sensors shows high correlation with biomass in grasses (Serrano *et al*., 2000).

Total crop biomass was measured by collecting crop samples and the relationship between normalized difference vegetation index (NDVI) from a hand-held sensor and the estimated crop biomass was evaluated. The objective of the study was to assess the ability to monitor the development of cover crop mixtures and be able to estimate final crop biomass through the use of non-destructive NDVI sensors. Partial results are reported in this paper.

2 Materials & Methods

2.1 Experimental Design

The cover crop trial was set up at Zannas Farm owned by the American Farm School, which is located in Chalkidona, Greece, with annual precipitation of 450 mm. The experimental design was a Complete Randomized Block Design (CRBD) with four blocks and six treatments within each block. The size of each plot was 30 x 9 m.

Five cover crop systems were used; a) AVEX + Rye, b) TRITIMIX, c) Vetch + Oats, d) Rye, e) Lollium, and f) a non-cultivated fallow as a control. The crop composition of each multi-species mixture is listed in Table 1. The two crop mixtures AVEX and TRITIMIX were provided by the seed company Fertiprado in Portugal. The field was cultivated and planted in mid-January. The establishment of the cover crops was originally planned for late October, but due to unusual wet weather in

Northern Greece during the months of October to December we were not able to prepare the fields and plant before January.

Table 1. Composition of cover crop mixtures

Cover crop misture	Original cover crop species	Added species
AVEX + Rye	*Avena strigosa, Lollium multiflorum Vicia vilosa, Vicia Sativa, trifolium suaveolens, trifolium squarrosum, trifolium bersim*	12.5% rye (*Secale cereale)*
TRITIMIX	*Triticum secale, Lollium multiflorum, Vicia vilosa, Vicia sativa, Trifolium suaveolens, Trifolium squarrosum, Trifolium bersim*	
Vetch + oats	*Vicia sativa* (80%)	20% oats (*Avena sativa*)

The seeding rate used listed in Table 2. There was no fertilizer added to the plots.

Table 2. Seeding rate of cover crops

Cover crop mixture	Kg/ ha, primary mixture	Kg/ha, added crop
AVEX + Rye	61	9
TRITIMIX	70	–
Vetch + Oats	56	14
Rye	70	–
Lollium	70	–

2.2 NDVI and incident Photosynthetically Active Radiation (PAR) light monitoring

NDVI monitoring was performed using an NDVI hand-held sensor. PAR light above and below the cover crop canopy was measured with a canopy analysis system (Delta-T Devices SunScan SS1) and the percent of PAR light intercepted (Li %) was calculated using equation 1.

$$Li\ (\%) = \left\{1 - \left(\frac{PAR_t}{PAR_b}\right)\right\} * 100\ . \quad (\mathbf{1})$$

Where Li = PAR light intercepted, PAR_t = PAR transmitted through the canopy, PAR_b = PAR beam incident upon the canopy.

2.3 Field biomass sampling

In early May, at the full flowering stage for most crops, three samples from each plot were harvested using a 0.5m*0.5m square frame. The weeds were separated and the samples were dried at 60°C to a constant dry weight.

2.4 Statistical analysis

Statistical analysis was performed using JMP Pro v.11.0, SAS Institute Inc.

3 Results & Discussion

All five cover crop systems evaluated were able to suppress weed growth in most experimental plots. The cover crop with the highest biomass was TRITIMIX, which was significantly higher than the single-species cover crops Lollium and Rye, with an estimated biomass of 12,470 kg/ha (Table 3.). AVEX+Rye and Vetch+Oats had the second largest biomass, but they were not significantly different from Lollium or Rye (Table 3).


a
b
c

Fig. 1. The three photos illustrate the experimental plots with cover crops (a, b) and the non-cultivated fallow plot (c).

Light interception by the cover crops ranged from 92.5% for Vetch+Oats to 38.3% for Rye (Table 3). Even though Rye allowed more radiation to penetrate its canopy, there were no weeds detected in the Rye plots, possibly due to the allelopathic properties of Rye.

One possible explanation for the small differences detected is that the cover crops were planted late. This prevented the legumes in the multi-species cover crops from optimal development, while the grass species were better able to develop in the colder temperatures of January. Legumes in the multi-species cover crops did not perform as well as grass species and contributed less than their full potential in total biomass (data not shown).

Table 3. Biomass, NDVI and % Li of cover crops before termination.

Cover crop	Biomass (kg/ha)		Weed Biomass (kg/ha)	NDVI		Intercepted PAR (Li %)	
TRITIMIX	12,470	a	ND*	0.63	b	64.9	a,b
AVEX + Rye	10,335	a,b	ND*	0.69	a	74.9	a,b
Vetch+Oats	9,910	a,b	ND*	0.71	a	92.5	a
Lollium	7,105	b,c	ND*	0.69	a	60.6	a,b
Rye	5,950	b,c	ND*	0.61	b	38.3	b,c
Fallow	2,630	c	-	0.36	c	20.9	c

Levels not connected by the same letter are significantly different (LSD at the 5% level)

*ND = weeds not detected

Using a regression analysis of the relationship of NDVI with crop biomass found that it was not statistically significant, when analyzing all field plots (Fig. 2).

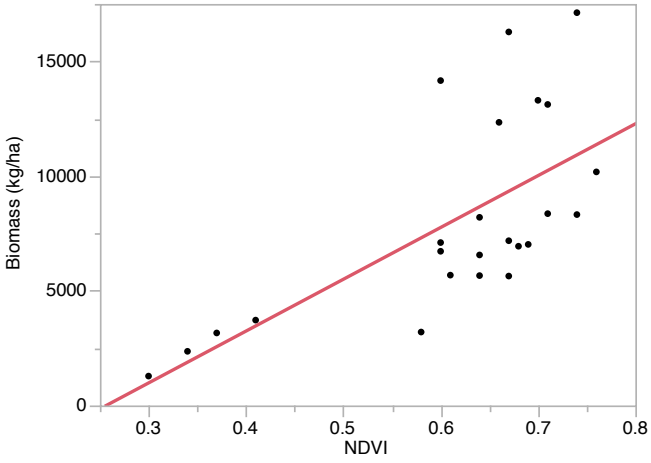

Fig. 2. Regression analysis of biomass vs. NDVI of all cover crops.

When single cover crop systems were analyzed though, the relationship of NDVI and crop biomass was statistically significant for the single cover crop species plots

(Table 3.). A strong regression relationship was found for Lollium (R^2=0.94) and for Rye (R^2=0.81). A similar relationship was found in the fallow plots, which were not cultivated and only weeds were grown. The inability to obtain a good regression relationship between NDVI and crop biomass can be attributed to the complex canopy structure of densely planted cover crop mixtures, which contain grasses and legumes. Grains, such as rye and oats grow taller, while some of the trifolium species of legumes remain lower in the canopy. As leaf area index increases, the regression relationship becomes weaker and NDVI cannot be used to predict biomass reliably (Serrano *et al.*, 2000).

Table 3. Results of the regression analysis of biomass vs. NDVI for individual cover crops.

Parameter	R^2
All field plots Biomass vs. NDVI	0.45*
Lollium biomass vs. NDVI	0.94*
Rye biomass vs. NDVI	0.81 ns
Tritimix biomass vs. NDVI	0.34 ns
Vetch-oats biomass vs. NDVI	0.42 ns
Avex+Rye biomass vs. NDVI	0.47 ns
Fallow biomass vs. NDVI	0.99*

* Significant at the 0.05 probability level.

4 Conclusions

All cover crop systems studied performed well in producing sufficient biomass and suppressing weed development in the experimental plots. Multi-species cover crops were more productive and demonstrated the potential to provide higher biomass and very satisfactory weed suppression. In terms of using remote sensing to monitor cover crop development, the complex canopy structure of a densely planted multi-species cover crop, presents a greater challenge in using an NDVI sensor as a monitoring device. Further studies will be required to determine a method of using NDVI sensors in the ground and/or aerial measurements to estimate biomass in multi-species cover crops. The handheld NDVI sensor along with the canopy analysis system (PAR and Li) can be used successfully in estimating very efficiently the biomass in single cover crops systems.

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Session 9: Data Analysis on Animal/Fishery Products Processes (part 1)

A Sensor Based Management and Monitoring System for the Identification of Lambs Focusing on Milk Productivity Upturns

Dimitrios Godas[1], Sotirios Kontogiannis[2], Markos Tsipouras[3], Stavros Valsamidis[4] and Themistoklis Lazaridis[5]

[1]Department of Business Administration, Technological Educational Institute of West Macedonia, Grevena, 51100, Greece, e-mail: k4mikazi666@gmail.com
[2]Department of Business Administration, Technological Educational Institute of West Macedonia, Grevena, 51100, Greece, e-mail: skontog@ee.duth.gr
[3]Department of Business Administration, Technological Educational Institute of West Macedonia, Grevena, 51100, Greece, e-mail: markos.tsipouras@gmail.com
[4]Department of Accounting, Technological Educational Institution of East Macedonia and Thrace, Ag. Silas, 65500 Kavala, Greece, e-mail: svalsam@teikav.edu.gr
[5]Department of Business Administration, Technological Educational Institute of West Macedonia, Grevena, 51100, Greece, e-mail: themis@themis.gr

Abstract. This paper presents a new system architecture and test bed application implementation called Sheep Manager. Sheep Manager system uses NFC technology for the identification of sheep inside a flock as well as sensors for the real-time measurements and recording of raw milk extraction per ewe. All recorded information are then stored into the cloud. Authors also propose an algorithm for sheep breed selection that uses feedback information from past successful breeds in order to increase milk productivity.

Keywords: sheep management system, breed selection algorithm, sensor based system, NFC technology.

1 Introduction

The demand for animal traceability and identification follows a continuously increasing curve. Nowadays tools that provide identification capabilities in combination with animal attributes traceability that characterize each animal in a flock are a necessity. Such necessity for livestock identification on the sheep industry, may assist for the prevention of certain forms of transmissible spongiform encephalopathy or other disease forms, increase the quantity and quality of products such as milk, cheese or wheat and assure low cost but of a high standard nutritional food for the stock.

From the consumer's part, animal traceability is a very important aspect. Traceability nowadays does not cover only the ability to trace the product back to its producer or production date or present information regarding products' ingredients as a result of chemical analysis. On the contrary, attributes regarding sheep's nutritional

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habits, environmental growth conditions, herd grazing time, or other metrics regarding flock hygiene are also of importance and need to be traced.

From a technological point of view, RFID technology is set to be the key player for animal identification in livestock. RFID technology shows advantages over previous technologies such as barcodes or QR-codes. RFIDs do not require direct line of sight and are not easily tore or worn. RFID tags have longer reading range. There are tags that have writing capability (with the use of specific recording device up to 4KB in passive and 1MB in active tags). Furthermore, there are RFID sensor tags (active or semi-passive energy harvesting tags) that include sensors and may transfer measurements of temperature, humidity, vibration, luminosity etc. up to 100 meters away (Ruiz-Garcia and Lunadei , 2011), (Hammer et al., 2015).

Regarding feeding technologies and nutritional habits of ewes in the Mediterranean environment for the purpose of improving milk quantity and quality, sensors and sensor networks can play a very important role. Sensors may affect animals' nutritional habits and increase milk quantitative and qualitative characteristics. Sensors that monitor confined lactating ewes' environmental conditions may lead to the reduction of ewes' heat stress. Sensors that monitor and coordinate irrigation of grazing fields, especially in summer seasons also affect positively ewes' nutrition. Moreover, since feeding value of crop residues especially in summer is often low, a sensor based system that coordinates mixing of forage or other forms of nutritional additives in silos increases milk productivity and qualitative characteristics (Sitzia et al., 2015), (Gaja et al., 2005).

Finally, passive injectable RFID transponders are used instead of ear tag based ones or neck lace placed ones. Injectable identification transponders is a far better technique in terms of safe-placement and accuracy (Gaja et al., 2005), (Collin et al., 2002),but still receives susceptibility from producers and requires further research and validation (Collin et al., 2002). In extent, RF energy harvesting techniques are nowadays investigated for powering up passive injectable RFID transponders with incorporated RF power up sensors.

In this paper authors present an architecture and implementation of a sheep identification and sensor management system called Sheep Manager. Sheep Manager uses NFC close contact RFID technology for the identification of sheep and flow sensors installed in the milking machine for the recording of ewe milk production. Identification information of ewes' daily milk production as well as per ewe nutritional daily habits is recorded to an Information system set as the cloud. Sheep manager system comes with an android Sheep Client application and a breeding algorithm that selects the appropriate sheep to breed based on productivity trends and incest avoidance.

2 Cloud and NFC Technologies Used by the Architecture

RFID is the technology used for identifying items using radio waves. At a minimum, an RFID system includes a tag, a reader, and an antenna. The reader sends a request to the tag via the antenna, and the tag replies with its unique stored information. RFID tags are either active or passive and use either: 1. Low

Frequencies (LF) 125 -134 kHz, 2. High Frequencies (HF) 13.56MHz, 3. Ultra High Frequencies (UHF) 433, 856-960MHz and 4. Microwave Frequencies 2.4-3.1 GHz for request reply data transmission (Ruiz-Garcia and Lunadei, 2011), (Voulodimos et al., 2010), (Hammer et al., 2015). RFIDs can cover distances from 10cm to 300m for UHF and microwave frequencies and from 10cm to 1m for MF and LF frequencies (Ali et al., 2014), (Ruiz-Garcia and Lunadei, 2011).

2.1 NFC Identification Technology Used

NFC is a close contact RFID technology that operates at 13.56 MHz. It uses ISO/IEC 14443 standard for contact-less smart cards operating in close proximity (~10cm) with a reader antenna, an extension of High Frequency (HF) RFID standards. NFC therefore shares many similar physical properties with RFID such as one way communication and the ability to communicate without a direct or clear line of sight.

There are however four key differences between RFIDs and NFC technologies (Ali et al. , 2014): 1. NFC is capable of two way communication and can therefore be used for more complex interactions such as card read-write operations performed from the same device and peer-to-peer (P2P) sharing, 2. NFC devices are limited to communication at close proximity, 3. Only a single NFC tag can be scanned at one time of interaction while RFID enforces simultaneous scanning and 4. NFC transponders are now included in a majority of mobile phones and this is perhaps the most important difference between NFC and RFID. Table 1 presents the major differences of both technologies.

Table 1. Comparison of NFC and RFID technologies.

Characteristic	RFID technology-passive	NFC technology
Operating Frequency:	LF/HF/UHF	HF:13.56MHz
Communication:	One way (One device for read another for write)	Two way-(RW operations simultaneously)
Standards:	ISO 14443, 15693, 18000	ISO 14443
Scan Tags Simultaneously:	Yes	No. – Faster scanning time
Incorporated into mobile phone:	No	Yes for contactless transactions

Concluding, based on NFC characteristics, it is obvious that NFC technology can perform similar to RFID (with the exception of close contact) and provide vast portability, easy to program and easy to use capabilities.

2.2 Collection of Livestock Data

Collection of livestock sensor data or NFC identification is performed by a simple HTTP POST operation of a session upload protocol following the Representational State Transfer (REST) architecture (Richardson and Ruby, 2007). That is, clients send HTTP requests to an open service to the Information system application server and the application service stores the request data to the database using prepared SQL statements (transactions). The format that the data are being transmitted follows the (REST) architecture for session protocols (Richardson and Ruby, 2007).

REST session protocols are a simple way to organize interactions between independent systems. REST allows you to interact with minimal overhead with mobile phone clients and other websites. REST uses JSON (JavaScript Object notation) and POST/GET HTTP requests for data transmission. In theory, REST is not tied to the web and can be used wherever HTTP protocol is used.

The alternatives of REST are complex implementations. That is, conventions on top of HTTP with the form of a XML-based language notation. The most illustrious example is SOAP. SOAP provides session level complexity with protocol conversion mechanisms (XML encode- XML parse, service requirements and processing capabilities), and thus not using HTTP to its fullest power. Because REST has been inspired by HTTP and plays to its strengths, it is the best and simplest way to transmit HTTP data in terms of `variable=value`.

3 Proposed System Architecture

Authors propose a system called Sheep Manager for the identification and recording of sheep productivity and characteristics. The proposed system uses NFC tags and NFC capable mobile phones for the performance of read-write operations on tags. Authors also propose a breeding selection mechanism that is included in the system. All system information along with nutritional data and sheep attitude characteristics are send into the *cloud*. That is, an application server equipped with a MySQL database that records productivity and animal profile information.

3.1 The Sheep Manager System

The sheep manager system architecture is presented at Fig. 1 and includes the following structural parts:

S1: The Application server where the owner of each stockyard authenticates himself with the Information system application service in order to gain access to its private database, where recording of information regarding his herd takes place.

S2: The main sheep yard of a closed establishment, where sheep milk gets extracted with the use of an electrical milking machine (Fig. 1 rectangular dashed line area), with coral or pen extensions where ewes wait for their milking process. This area is equipped with Internet connectivity via appropriate DSL router and Wi-Fi coverage (Wi-Fi access point-ADSL router). In the same area resides the modified

milking machine and sheep owner's mobile phone with the Sheep Manager NFC client application. All sheep are equipped with their own NFC tags, previously initialized with a unique id and places behind their ear.

The sheep owner has the ability to:

- Write a new tag with a new ID and add it to a newborn ship.
- Update information regarding sheep's gender, mother ID, father ID, mood or characteristics or nutritional habits and upload such information to the tag (sheep's profile information) and therefore to the application server.
- Perform an ID read and collect sheep's profile information by placing his phone in close proximity to the sheep's ear.
- Perform a breed search between an ewe and a ram by placing his phone in close proximity of both sheep ears and ask the application server to check if such breeding is permissible.
- Capture and upload data of milk extracted per sheep in liters (lt) with the use of two sensors located into the milking machine.

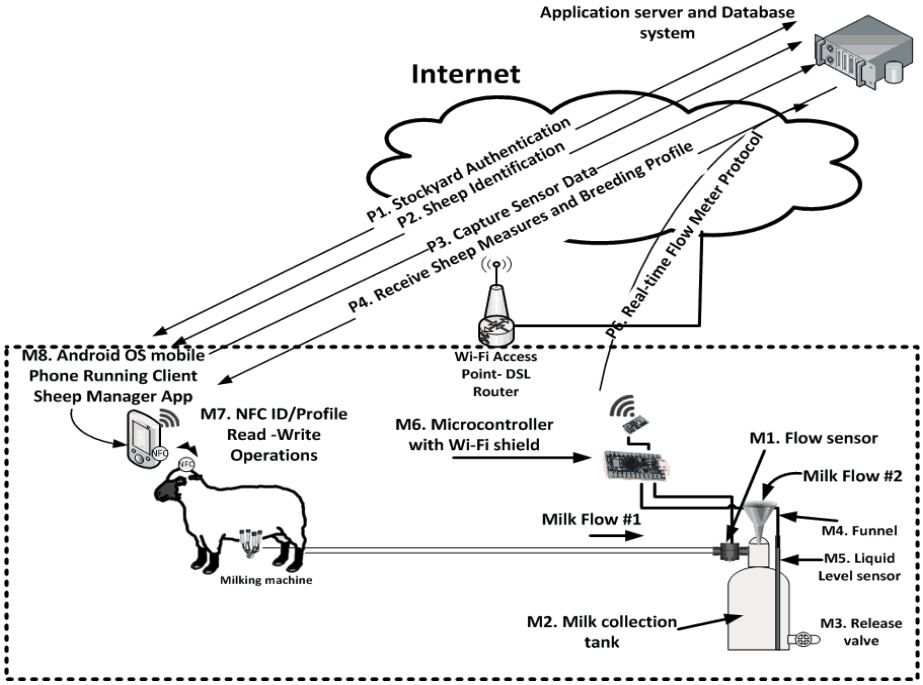

Fig. 1. Sheep Manager system high-level architecture. Figure shows the ewes' permanent closed yard where the milk is extracted and information between sensors and Application server is exchanged via the Sheep-Manager Application

The modified milking machine includes two sensors (see Fig. 1, Milk Flow #1 and #2): A flow sensor M1, located at the milking machine hose and a liquid level sensor M5, located inside the milk collection bottle of the machine. Both sensors are

controlled by a microcontroller equipped with a Wi-Fi shield, in order to connect via the access point to the application server and upload its measurements. Measurements upload from microcontroller to the application server, are performed upon request from the Sheep Manager client application (mobile phone of the sheep owner) upon request and the collected data of milk quantity (in liters) is stored and accumulated to the daily record of the sheep that was last identified by the owner's mobile phone. That is, daily total milk quantity sums are stored automatically by the application server at the end of each day and statistical means of productivity are updated.

The use of two sensors instead of one in the milking machine for the calculation of milk extraction per sheep is for calibration purposes of the flow sensor M1, since milk's density and viscosity changes from sheep to sheep area to area and time of year and milking pumps of machines have different flow rates and technical specifications (flow sensor is a cheap sensor to use but requires frequent calibration).

In case of multiple milking machines, one flow sensor can be installed to only one machine for other machines to calibrate. Finally, if the milking machine's pump is out of order and the milking process needs to be performed by hand, the measurement of produced milk is not lost. The milkman can pour the milk with the use of a funnel from the top of the collection bottle and measure its quantity without the use of the flow sensor.

Furthermore, all milk quantity measurements are performed in a differential real-time manner: That is, *time 0,* is the time where an ewe is NFC identified. The milk in the bottle at that time is considered as milk of 0 liters for that animal. When the milking process of that animal is finished and another animal enters the milking area and identifies itself with the NFC tag, then this is considered as *time 1* for the previously identified sheep. The (*time 1– time 0)* milk quantity is considered to be the extracted milk quantity in liters of the previous sheep, as uploaded to the application server.

Authors' proposed system architecture is close to the FARMA platform proposed at (Voulodimos et al., 2010). The main differences between FARMA and authors' implementation follow:

1. Our architecture utilizes NFC instead of RFID technology for the sheep identification process. In fact our solution is portable to any Android mobile phone NFC capable, while FARMA solution requires an RDIF reader-writer embedded into a mobile device usually a small notebook or PC.
2. Our architecture uses sensors to transmit data (milk quantity extracted per sheep and may include other sensors) and focuses only to sheep industry.
3. Our architecture uses different implementation technologies. While FARMA utilizes C# for its client application and protocol and SQL database server and IIS-ASP for its Application services, our implementation uses Android Java for the client, a REST HTTP mechanism instead of an XML data transmission mechanism for data collection and PHP-MySQL-Apache for the database and Information system application services.

3.2 Proposed Breeding Algorithm

Authors proposed breeding algorithm uses two independent processes:

Process 1: The **pure breed selection algorithm**, where a check for breed is performed up to the depth of k generations set be the milk owner (default value of k is set empirically to 7 generations). If there is a common ancestor between an ewe and a ram for a depth of k then the breeding process is denied as a degenerated one and appropriate alert message is displayed into the Sheep client application. If no common ancestors found then process 2 takes place.

Process 2: In this process the average yearly milk production by that ewe is compared to that of the herd. That is, a percentage threshold set by the farm owner of the milk quantity of the ewe that produced the maximum average yearly quantities in the herd. If milk quantities of that ewe are bellow threshold then a warning message is displayed to the Sheep client application for actions to be taken (The breed can be performed).

With mID being the potential ewe ID and fID being the potential ram ID in the Information system's database, the **pure breed selection algorithm** operates as follows:

```
Pure_breed_selection_algorithm (mID, fID)
        P = [mID, fID]
        P = sort(P)
        prevP = P
        gen = 0
        common = 0
        while (gen<= k) and (common == 0)
                tempP = ∅
                foreachitem in prevP
                        [item_mID, item_fID] = search(item, database)
                        tempP = tempP∪[item_mID, item_fID]
                end
                tempP = sort(tempP)
                P = merge(P, tempP)
                gen = gen + 1
                prevP = tempP
                if check(P) common = gen
        end
        return common
end
```

where:

- sort is a sorting function (quick sort).
- search is a search function for an item ID in the database (binary search) and returns the item's mother and father IDs (item_mID and item_fID).
- merge is a function merging two sorted arrays.

- check is a function that checks for common ancestor existence. Since P is a sorted array with IDs, a common ancestor will appear as two consecutive same IDs. Thus, check function returns 1 if there are at least two consecutive positions in the P array with the same value, and 0 otherwise.

The algorithm returns the first generation with a common ancestor or 0 (if there is no common ancestor in the last k generations).

4 Testbed Sheep Manager Client Application Implementation

The Sheep Manager Client application is an Android application can be installed into the sheep producer's Android OS mobile phone (Godas and Kontogiannis, 2014). The application authenticates the farm owner into the information system and the system's database where the farm owner records information regarding its livestock. The application's main window and sub-activities are illustrated in the following Fig. 2:

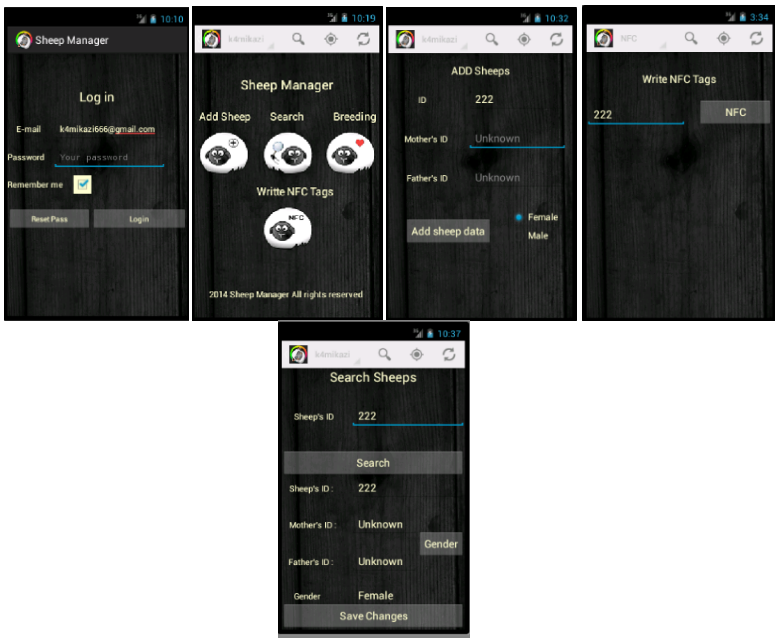

Fig. 2. Sheep Client application Main window and Dialogs-activities: A1. Farmer Application Authentication Window, A2. Main Window, A3. Add sheep Activity then write NFC tag activity and A4. Search sheep activity by hand or by NFC tag touch.

The Sheep Manager application has the following capabilities:

A1. Authenticate to the Sheep Client Application server. The farm owner authenticates himself to the Sheep Manager system service with a

username and password via HTTPS protocol in order to acquire access to his flock database.

A2. Sheep Client application Main Activity. This form shows the available application options of adding a sheep to the flock database and searching for a specific sheep. Delete and update operations have not been implemented and can be performed only by the Sheep Manager application and database server administrator.

A3. Add NFC tag and overwrite identification activity. In this activity the farm owner fills out an ID for the NFC tag to be placed to a newly born sheep. He also fills out the sheep's gender as well as its mother's and father's ids. Then by clicking Add sheep data button a Timer instantiates that gives time to the sheep owner to place his phone in touch proximity near the sheep's ear. When the characteristic NFC found sound occurs a new activity called write NFC tag is instantiated and by pressing write the tag is overwritten.

A4. The search Activity has dual operation. That is, read NFC tag ID automatically by placing the mobile phone in close contact to the NFC tag. Then sheep's ID is revealed and searching information regarding the selected sheep from the Information system's database (Mother ID, Father Id and gender) by clicking search button.

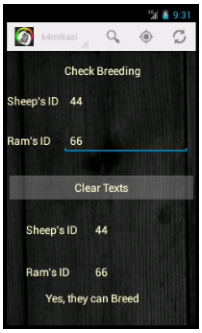

Fig. 3. Sheep Manager application check breed activity form with breed check algorithm

Finally, in the preliminary Sheep Manager application a breed activity form (see Fig. 3) is included, where the breeding search algorithm was incorporated. This preliminary version of breeding algorithm has the ability to search for ewe's sheep ID in comparison to a ram's ID in depth of k generation and check whether they can breed or not. Generation search parameter k can be set by the sheep owner and by default is initialized to the empirically set by sheep breeders value of seven generations-level search.

The breed selection is set to true only if both sheep ancestors have never breed before in depth of seven generations. This is because from our preliminary studies regarding breeding and milk production seven generations distance between ram and ewe was mentioned by farm owners as a good start point for sheep race breeding in order to avoid incest that affects milk quality.

5 Conclusions

In this paper authors propose a Sheep manager system that uses NFC technology for sheep identification and breed selection purposes, accompanied by suitable proposed breeding algorithm. Sheep management system is also capable for monitoring ewes daily milk productivity, sheep nutritional habits and sheep race-breed and character characteristics for traceability purposes.

Authors implemented their proposed system NFC sheep identification and selection part. This preliminary implementation includes a client application installed into the sheep owner mobile phone in order to perform read-write NFC operations and perform breed requests. Also authors propose a breeding algorithm that is also implemented to the proposed system for the purpose of sheep breeding check and validate.

Authors set as future work the final implementation or their system into a live herd where both milk sensor data as well as nutritional information per sheep shall be recorded automatically to the Sheep manager application service.

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The Evaluation of Meat Consumption Based on Different Models of the Matrix of Growth

Nada Lakić[1], Mirjana Krivokapić[2], Ana Anokić[3]

[1]Faculty of agriculture, University of Belgrade, Serbia, e-mail nlakic@agrif.bg.ac.rs
[2]Faculty of agriculture, University of Belgrade, Serbia, e-mail krivokapic.mirjana@gmail.com
[3]Faculty of agriculture, University of Belgrade, Serbia, e-mail anokicana@agrif.bg.ac.rs

Abstract. The dynamics and the structure of agricultural activities can be examined on the base of the matrix of growth. In this paper, the consumption of different kinds of meat in Central Serbia, during the period from 2000. to 2011, is analyzed using the matrix of growth and curvilinear trend. First, the growth of consumption of the *i*-th kind of meat was being observed as linear function, using average indirect rates of growth. Subsequently, the evaluation of meat consumption was performed using econometric linear model and non-linear system of Cobb-Douglas type. The curvilinear trend is applied for the same goal. The results obtained by these methods were compared with the data of the realized average consumption of the observed types of meat for year 2012. It was concluded that the matrix of growth gives equally good results for forecasting the average consumption of meat like trend method.

Keywords: the matrix of growth, linear and non-linear econometric system, curvilinear trend, meat consumption.

1 Introduction

The meat production in the world has great economic and especially nutritional significance. In human nutrition the meat is used in fresh and processed state. With human population growth, respectively with the increase in consumer purchasing power, the world meat production becomes increasingly important economic factor. The meat, in human diet, satisfies most of the needs for proteins of animal origin, whose biological value and structural quality are considerably higher compared to plant proteins and are necessary for the construction and reconstruction of tissue. Meat contains carbohydrates and fats, which are important for generation of heat and energy of the human body. The meat is a source of essential minerals such as iron, zinc and phosphorus which are significant for human organism being because they participate in bone structure, as well as teeth, blood and other. Also meat contains vitamins, especially B group (thiamin, riboflavin, niacin, pantothenic acid, vitamin B_6 and vitamin B_{12} which promote the growth and preservation of health. The effects of meat on physical health and mental well-being are well known, and new knowledge about human consciousness, considering healthy nutrition, yield to the individual human need for control of meat consumption. In the study by Vinnari and

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Tapio (2009), five coherent images of different views of meat consumption in future are constructed. The fact that meat represents agro-industrial materials for production of numerous high-value and expensive meat products which are highly appreciated in the market, confirms the importance of meat. Producers in markets all over the world are making great efforts to satisfy the consumer expectations in terms of quality and well-organized supply chains, and numerous studies are carried out in this direction (Henchion et al., 2014).

Mutual relations in the field of the consumption of the material goods, especially those intended for human diet as one of the most important consumption groups, can be analyzed by setting the matrix of growth and the corresponding model where direct and indirect relations are explicitly expressed. Analysis and evaluation of consumption of certain types of meat can help to adequately adjust the structure of production with demand structure in the next period. By predicting the consumption of meat the necessary import can be ensured on time. The goal of this paper is to present the prediction of meat consumption obtained using the matrix of growth and compare it with the results obtained by widely used trend methods.

Forecasted values of different productions (Krivokapić and Anokić, 2012) can be obtained using matrix of growth and also the movement of GDP by regions can be analyzed (Anokić et al, 2013) using this method. More examples from literature of using matrix of growth is for setting up a multimodal transport model in Croatia (Nikolić, 2003) or for demographic analysis (Kovačić, 1976).

2 Method

The matrix of growth is a square scheme formed of direct and indirect rates of growth. Direct rate of growth expresses the growth of one single activity independently from the growth of other observed activities. The indirect rate of growth denotes relative growth of the *i*-th activity in relation to the value of the *j*-th activity in the previous (*t-1*) or the currently observed *t* time period. By simultaneous covering of both direct and indirect rates of growth, the matrix of growth enables, in addition to the intensity of growth, the identification of structural changes between observed activities.

Activities at the beginning and the end of the observed period can be connected with the average matrix of growth. Using the matrix of growth it is possible to establish the dynamic system for projecting future structural relations. Different types of meat can substitute one another in nutrition, which means that the levels of their consumption are mutually dependent, that is, the increment of consumption of the *i*-th kind is the function of the level of consumption of all other kinds of meat. Depending on the relationship between the increments of consumption of the *i*-th kind of meat and the level of consumption of all kinds of meat, different models of growth can be defined. A model based on indirect rates of growth and econometric linear and non-linear system of Cobb-Douglas type is used in this paper. Subsequently, the method of curvilinear trend was applied. Selection of a line that is best adapted to the actual data was estimated based on the index of correlation. The equations of cubic and power trend, based on that indicator, are used in this paper.

2.1 Models of Consumption Growth

The increment of the consumption of *i*-th kind of meat in period (*t-1*,*t*) is:

$$\Delta Y_{it} = Y_{it} - Y_{i,t-1} \qquad i = 1,2,...,n \qquad \textbf{(1)}$$

There is a mutual dependence between consumptions of different kinds of meat, the increment of consumption of the *i*-th kind of meat, ΔY_{it}, is a function of levels of consumption of all other kinds of meat

$$\Delta Y_{it} = f_i\left(Y_{1t},...,Y_{i-1,t},Y_{i+1,t},...,Y_{nt}\right),\ i = 1,2,...,n \qquad \textbf{(2)}$$

Therefore, it is possible to establish a following system of equations:

$$Y_{it} - f_i\left(Y_{1t},...,Y_{i-1,t},Y_{i+1,t},...,Y_{nt}\right) = Y_{i,t-1},\ i = 1,2,...,n \qquad \textbf{(3)}$$

Depending on the kind of a relationship existing between the increment of the consumption of the *i*-th kind of meat and the level of the consumption, different models of growth are obtained.

A Model Based on Indirect Rates of Growth. Using indirect rates of growth in order to express linear dependency of consumption increment of the *i*-th kind and the level of consumption (Lakić and Krivokapić, 2008) there is a connection based on the relation between the consumption in two successive periods, in the matrix form:

$$\left(I - \frac{1}{n-1}R\right)Y_t = Y_{t-1}, \qquad \textbf{(4)}$$

where I and R represent a unit matrix and a matrix of growth, respectively, and Y_{t-1} and Y_t represent vectors of the consumption in period *t-1* and *t*, respectively. Assumed constancy of the matrix of growth means that changes between the consumption of different kinds of meat are allowed in absolute values, but only with condition that the relative relations remain unchanged.

In addition to its good sides, the observed system has weak points. Neglecting the fact that indirect rates of growth are changing from period to period and that they can be considered as constants only in the case when all direct rates of growth are equal, can be overcome by introducing average (constant) matrix of growth for longer period (*0*,*T*). Then it is possible to establish, for every moment of the interval (*0*,*T*), *t=1,2,3,…T*, a following connection between the consumption vectors Y_t and Y_{t-1}, based on the average matrix of the consumption growth:

$$\left(I - \frac{1}{n-1}\overline{R}\right)Y_t = Y_{t-1} \qquad \text{or} \qquad Y_t = \left(I - \frac{1}{n-1}\overline{R}\right)^{-1} Y_{t-1} \qquad \textbf{(5)}$$

On the basis of the last equation based on a known vector of consumption in period (*t-1*) and average matrix of growth $\overline{R}$, the vector of consumption in period *t* can be evaluated.

An Econometric Model. An econometric model based on the matrix of growth denotes structural changes of the consumption by connecting its trend into the complete dynamic system. By this system, the structure of growth which is used to connect two states of consumption is revealed.

An econometric model can be formed on the basis of linear and nonlinear dependence of coefficients of growth.

a) A linear econometric model

In the case of the linear dependence of coefficients of growth, the consumption of observed kinds of products in period *t* and *t-1* is expressed via the following system of equations:

$$Y_{it} - \sum_{j \neq i=1}^{n} r_{ij} Y_{jt} = Y_{i,t-1} \quad \textbf{(6)}$$

or in matrix form:

$$(I - R)Y_{t-1} = Y_t \ , \quad \textbf{(7)}$$

where I and R represent a unit matrix and a matrix of coefficients of growth, respectively, and Y_{t-1} and Y_t represent vectors of the consumption in period *t-1* and *t*, respectively.

In the case of the linear dependence upon parameters, the increment of consumption in period *t* is equal to the following expression:

$$\Delta Y_t = a_1 Y_{1t} + a_2 Y_{2t} + \ldots + a_n Y_{nt} + \varepsilon_t , \quad \textbf{(8)}$$

where $\varepsilon_t = (\varepsilon_1, \ldots, \varepsilon_t)$ is an error or a deviation from the linear dependence. Considering that the sum of squared deviations is

$$\sum_{t=1}^{T} \varepsilon_t^2 = (\varepsilon', \varepsilon) = (\Delta Y - Ya)'(\Delta Y - Ya) \quad \textbf{(9)}$$

the first derivative of a is

$$\frac{\partial(\varepsilon', \varepsilon)}{\partial a'} = -2Y'(\Delta Y) + 2Y'Ya' \quad \textbf{(10)}$$

Equalizing this derivative with zero, the following is obtained:

$$a' = (Y'Y)^{-1} Y'(\Delta Y) \quad \textbf{(11)}$$

If the label on the $\hat{R}' = (a_1, a_2, \ldots, a_n) = a'$, the transposed matrix of evaluated coefficients of growth is obtained:

$$\hat{R}' = (Y'Y)^{-1} Y'(\Delta Y) \quad \textbf{(12)}$$

The evaluation of the consumption in period *t*, when the consumption in period *t-1* is known, is being performed using the following relation:

$$Y_t = \left(I - \hat{R}\right)^{-1} Y_{t-1} , \quad \textbf{(13)}$$

in which matrix $\hat{R}$ is the transposed matrix of evaluated coefficients of growth.

b) An econometric model based on non-linear dependence of Cobb-Douglas type

The change of phenomenon in period (*t-1*, *t*) can be followed also using coefficients of dynamics of the consumption which expresses the relation between the levels of the consumption of the *i*-th kind of meat in currently (*t*) and previously observed (*t-1*) period, i.e.:

$$d_{it} = \frac{Y_{it}}{Y_{i,t-1}} \qquad i = 1,2,...,n \; ; \; t = 1,2,...,T \tag{14}$$

The coefficient of the consumption can also be expressed as a function of the consumption of Cob-Douglas type:

$$d_{it} = Y_{1t}^{e_{i1}} \quad . \quad . \quad . \quad Y_{nt}^{e_{in}} \qquad \text{or} \qquad \log d_{it} = \sum_{j=1}^{n} e_{ij} \log X_{jt} \tag{15}$$

In this process, the coefficients of elasticity of growth are marked as e_{ij} ($i,j = 1,...,n$).

Connections between different kinds of meat can be expressed using following system of equations:

$$\log Y_{it} - \sum_{j=1}^{n} e_{ij} \log Y_{jt} = \log Y_{i,t-1} \qquad i = 1,2,...,n \tag{16}$$

or in matrix form:

$$(I - E)\log Y_t = \log Y_{t-1} \tag{17}$$

The solution of this system gives the connection between vectors of the consumption in period *t* and *t-1* respectively:

$$Y_t = e^{(I-E)^{-1}} \log Y_{t-1} \, . \tag{18}$$

Repeating the previous procedure the transposed matrix of the coefficients of elasticity is determined by:

$$\hat{E}' = \left[(\log Y)'(\log Y)\right]^{-1}(\log Y)'(\Delta \log Y) \tag{19}$$

More theory about these issues can be found in Stojanović (1976 and 1990).

A Curvilinear Trend. With respect to the maximum value of the index of correlations, the parabola of the third degree and the equation of a power trend are used for extrapolation in this paper, respectively:

$$\hat{Y}_i = a + b_1 t_i + b_2 t_i^2 + b_3 t_i^3 \qquad \text{and} \qquad \hat{Y}_i = a * t_i^b \, , \qquad i = 1,2,...,n \tag{20}$$

The software package IBM SPSS Statistics Version 20 was used for extrapolation of the consumption in 2012 in this study.

3 Results and Discussion

The time series for the period from 2000 to 2011 for consumption of different kind of meat: beef, baby beef, veal, pork, pork of suckling pig, mutton, goat meat,

poultry meat, offal, fish and prepared fish in Central Serbia are used for the purpose of analyzing the dynamics of structural changes of consumption of different types of meat using methodology based on a matrix of growth (table 1).

Table 1: The average consumption of meat, fish and fish products in Central Serbia

Year	**Consumption of meat** (kg/per household)							
	beef and baby beef	**veal**	**pork**	**pork of suckling pig**	**mutton and goat meat**	**poultry meat**	**offal**	**fish and prepared fish**
2000	12.0	2.3	26.3	11.8	2.7	29.2	1.9	7.6
2001	13.1	2.2	25.6	10.5	3.1	30.6	1.9	11.2
2002	15.0	2.3	32.5	10.6	3.0	39.5	2.0	10.4
2003	15.5	2.6	33.8	10.7	2.3	39.2	2.5	14.5
2004	15.5	2.6	36.9	10.7	2.1	41.7	2.4	12.0
2005	14.3	2.5	35.6	9.2	2.0	42.3	2.4	15.5
2006	12.2	1.6	43.7	8.5	3.9	44.1	5.1	19.2
2007	12.7	0.5	50.7	8.9	4.2	45.3	7.6	18.6
2008	14.1	1.2	41.8	6.3	3.6	43.6	5.3	17.3
2009	11.7	0.4	41.8	6.3	4.2	52.1	3.9	17.2
2010	10.1	0.4	44.1	5.4	3.4	52.0	4.4	16.2
2011	11.8	0.8	43.8	5.5	2.7	49.6	4.0	19.5

Source: Bulletin, questionnaire of meat consumption, material-Office of Statistics of Republic of Serbia

Assuming that the consumption of meat in 2012 shows the same tendency as in the previous period, solution of the system defined on the basis of indirect rates of growth is used for the estimation of the consumption levels in 2012.

$$\begin{bmatrix} Y_{1,12} \\ Y_{2,12} \\ Y_{3,12} \\ Y_{4,12} \\ Y_{5,12} \\ Y_{6,12} \\ Y_{7,12} \\ Y_{8,12} \end{bmatrix} = \begin{bmatrix} 1.0002 & 0.0017 & 0.0001 & 0.0003 & 0.0008 & 0.0001 & 0.0007 & 0.0002 \\ 0.0015 & 1.0125 & 0.0005 & 0.0023 & 0.0062 & 0.0004 & 0.0052 & 0.0012 \\ -0.0171 & -0.1462 & 0.9942 & -0.0270 & -0.0725 & -0.0052 & -0.0602 & -0.0146 \\ 0.0062 & 0.0526 & 0.0021 & 1.0097 & 0.0261 & 0.0019 & 0.0217 & 0.0052 \\ 0.0004 & 0.0033 & 0.0001 & 0.0006 & 1.0017 & 0.0001 & 0.0014 & 0.0003 \\ -0.0030 & -0.0259 & -0.0010 & -0.0048 & -0.0128 & 0.9991 & -0.0107 & -0.0026 \\ -0.0010 & -0.0083 & -0.0003 & -0.0015 & -0.0041 & -0.0003 & 0.9966 & -0.0008 \\ -0.0072 & -0.0618 & -0.0025 & -0.01142 & -0.0306 & -0.0022 & -0.0255 & 0.9938 \end{bmatrix}^{-1} \begin{bmatrix} 11.8 \\ 0.8 \\ 43.8 \\ 5.5 \\ 2.7 \\ 49.6 \\ 4.0 \\ 19.5 \end{bmatrix} = \begin{bmatrix} 11.8 \\ 0.7 \\ 45.5 \\ 4.9 \\ 2.7 \\ 49.9 \\ 4.1 \\ 20.2 \end{bmatrix}$$

The consumption of beef and baby beef as well as the consumption of mutton and goat meat will remain at the same level in 2012, the consumption of veal and pork of suckling pig will decrease, and consumption of pork, poultry, offal and fish will increase compared to the previous year.

Further, using the matrix of estimated coefficients of growth, the following solution of the system of equations of the econometric model based on linear dependence is obtained:

$$\begin{bmatrix} Y_{1,12} \\ Y_{2,12} \\ Y_{3,12} \\ Y_{4,12} \\ Y_{5,12} \\ Y_{6,12} \\ Y_{7,12} \\ Y_{8,12} \end{bmatrix} = \begin{bmatrix} 0.0766 & 2.4752 & 0.0374 & 0.0725 & -0.0526 & 0.0661 & 0.1617 & 0.1809 \\ -0.2927 & 0.9255 & 0.1701 & 0.2602 & 0.1290 & -0.1003 & -0.3973 & 0.0466 \\ 2.2120 & 1.9462 & -2.2406 & -1.7806 & -3.5574 & 1.7960 & 9.4835 & 0.3162 \\ 0.1472 & 2.2920 & -0.3712 & 0.3716 & 0.4685 & 0.1788 & 1.3734 & 0.0210 \\ 0.4657 & -1.1171 & -0.4052 & 0.0858 & -0.2123 & 0.2481 & 1.2068 & -0.0625 \\ -0.0424 & 0.5229 & -2.1093 & 0.5049 & -3.9993 & 2.1955 & 6.6115 & 0.7779 \\ 0.8539 & 0.1738 & -0.3717 & -0.8271 & -0.1432 & 0.2134 & 1.9375 & -0.1808 \\ 1.3521 & -3.0085 & 1.6075 & -1.3805 & 1.4544 & -0.8909 & -4.1750 & 0.0165 \end{bmatrix}^{-1} \begin{bmatrix} 11.8 \\ 0.8 \\ 43.8 \\ 5.5 \\ 2.7 \\ 49.6 \\ 4.0 \\ 19.5 \end{bmatrix} = \begin{bmatrix} 10.9 \\ 0.5 \\ 43.7 \\ 5.0 \\ 3.3 \\ 47.8 \\ 4.7 \\ 21.5 \end{bmatrix}$$

Results of the system equations indicate that consumption of beef and baby beef, veal, pork, pork of suckling pig and poultry meat will decrease in the forecasted 2012 year. The consumption of other kinds of meat increased compared to the previous year. We noted, also that there is a tendency to replace one type of meat with another which is characteristic for the countries affected by the economic crisis. For example, poultry meat is a substitute for beef (Chamorro et al, 2012).

Econometric model based on the nonlinear dependence is based on the matrix of estimated coefficients of elasticity of growth. After a sequence of operations using natural logarithmic function and applying the procedure from the previous model, transposed matrix of elasticity coefficients is obtained and used for consumption evaluation in 2012.The system of equations gives the following results for 2012:

$$\begin{bmatrix} Y_{1,12} \\ Y_{2,12} \\ Y_{3,12} \\ Y_{4,12} \\ Y_{5,12} \\ Y_{6,12} \\ Y_{7,12} \\ Y_{8,12} \end{bmatrix} = e^{\begin{bmatrix} 0.1287 & 0.1402 & -1.0942 & 0.4337 & -0.1821 & 1.1937 & 0.3783 & 0.1935 \\ -2.3631 & 0.1307 & 16.4711 & 0.1669 & 0.8664 & -14.3768 & -5.5330 & 2.1467 \\ 0.9111 & -0.0186 & -2.7616 & 0.0549 & -0.4040 & 2.7065 & 1.1890 & 0.0081 \\ 0.7780 & 0.1184 & 0.8679 & 0.2152 & 0.3383 & -1.0737 & -0.3401 & 0.2166 \\ 2.4238 & -0.4697 & -1.8712 & -0.3780 & 0.1408 & 0.7539 & 0.5999 & -0.4299 \\ -0.0135 & 0.0563 & -5.2009 & 0.8363 & -0.6360 & 5.2302 & 1.8504 & -0.1044 \\ 2.8606 & -0.3047 & 0.1344 & -1.5643 & -0.1442 & -0.6934 & 0.7356 & -0.5556 \\ 0.4781 & -0.0512 & 1.7717 & -0.6212 & -0.0720 & -0.7778 & -0.0376 & -0.2493 \end{bmatrix}^{-1} \log \begin{bmatrix} 11.8 \\ 0.8 \\ 43.8 \\ 5.5 \\ 2.7 \\ 49.6 \\ 4.0 \\ 19.5 \end{bmatrix}} = \begin{bmatrix} 11.8 \\ 0.7 \\ 45.5 \\ 5.3 \\ 2.2 \\ 57.6 \\ 3.0 \\ 17.3 \end{bmatrix}$$

Obtained values show that consumption of following types of meat will decrease in forecasted 2012 year compared to the previous year: veal meat by 0.7 kg per household, suckling piglet meat by 5.3 kg, mutton and goat meat by 2.2 kg, offal by 3.0 kg and fish by 17.3 kg,. Consumption of pork meat will increase in 2012 compared to 2011 year by 45.5 kg and of poultry meat by 57.6 kg. It is forecasted that the consumption of beef and baby beef meat will have the same value of 11.8 kg per household. The prediction of the values of the average consumption of the observed types of meat per household in 2012 are obtained using the adequate equation of cubic and a power trend lines.

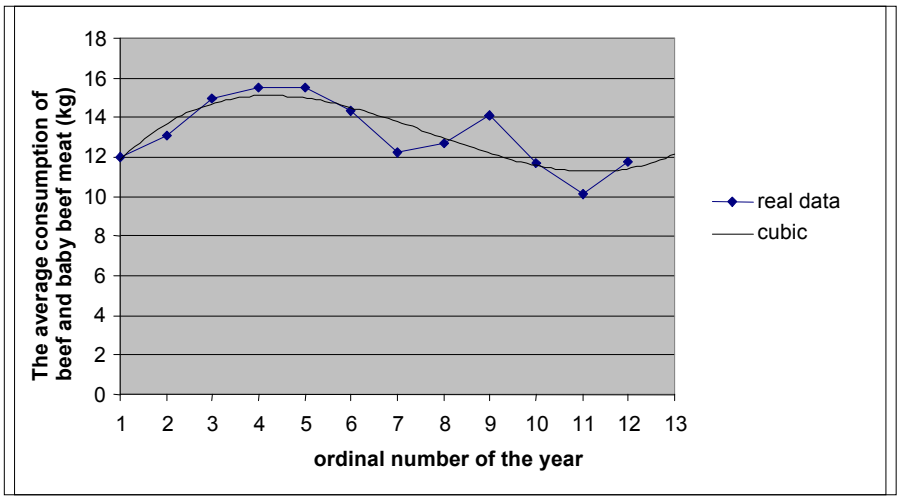

Fig. 1. Movement of the consumption of beef and baby beef per household in 2000 to 2011, and the adequate trend line

When it comes to the average consumption of beef and baby beef, the largest index of correlation in the amount of $I^2 = 0.731$ corresponds to the mathematical function $\hat{Y}_i = 9.145455 + 3.221895t_i - 0.524026t_i^2 + 0.022621t_i^3$. The projected average consumption of beef per household in 2012, using rated function is 12.2 kg (graph 1). For the average consumption of veal per household, the best adapted function with $I^2 = 0.862$ is obtained with forecasted consumption of 1.2 kg of veal

per household in 2012. Using the cubic function that best corresponds to the average consumption of pork with I^2 = 0.845, the consumption of 39.3 kg of pork per household in 2012 is forecasted. Cubic line with I^2 = 0.940 gives the best description for the average consumption of suckling pig meat per household and the forecasted consumption per household in 2012 is 4.7 kg. The largest index of correlation I^2 = 0.552 corresponds to the cubic line which projected the value of average consumption of sheep and goat meat per household for 2012 in amount of 1.5 kg. Levels of average consumption of poultry meat per household can be best modeled using a mathematical function of a power form $\hat{Y}_i = 28.369443 * x^{0.232894}$ with correlation index I^2 =0.921. The obtained forecasted value for 2012 amounts to 51.6 kg of poultry meat on average per household (graph2). When it comes to offal, the best adapted line is cubic with the correlation index I^2 =0.671 and the average consumption is 1.3 kg in 2012. For the assessment of the average consumption of fish and prepared fish a power function with correlation index I^2 =0.856 is used and the obtained forecasted value for 2012 is 19.9 kg.

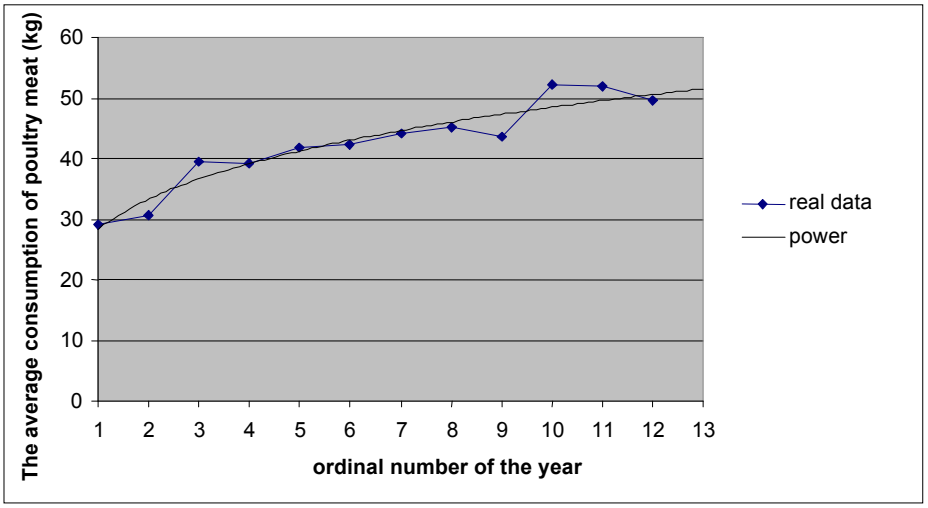

Fig. 2. Movement of the consumption of poultry meat per household in 2000 to 2011, and the adequate trend line

The forecasted values of average consumption of the observed kinds of meat per household in 2012, obtained by the model based on the matrix of growth, model based on the indirect rate of growth, linear and non-linear econometric model, and applying the curvilinear trend were compared with the actual average consumption data for the year 2012. The real average consumptions per household of beef and baby beef, pork, suckling pig meat in 2012 were 12.2 kg, 39.1 kg and 4.5 kg, respectively, and the closest results to them are those predicted by cubic trend. The best predicted values for average consumption of sheep and goat meat, offal and fish, which had the real values of 2.3, 3.6 and 17.1 kg, respectively, were obtained by non-

linear econometric model. The linear econometric model gave the best prediction for the average consumption of veal of 0.5 kg per household, which is equal to the real consumption of this kind of meat. The closest result to the real average consumption of poultry meat per household in 2012 equal of 49.1 kg was obtained by the method based on indirect rates of growth.

4 Conclusion

Structural changes of meat consumption are established through direct and indirect rates of growth, using the matrix of growth for period from 2000 to 2011. Using appropriate models, prediction of consumption for the next year is performed. The three models that had been used gave different estimates of meat consumption by kinds of meat, as a result of their different approaches to the problem.

This paper confirmed the thesis that matrix of growth can be applied in the analysis of meat consumption and forecasting for the next period of time. In addition to many modern methods, of which the trend is commonly in use, the results obtained by the presented computation using the matrix of growth, have shown the way to determine the consumption trend and an appropriate assessment of meat consumption in the future. Considering that the method of indirect rate of growth and the linear econometric methods provided the value for one type of meat that was closest to the real value, projecting the consumption for the next year, while the econometric method based on nonlinear dependence and curvilinear trend values obtained closest values to the real data for three kinds of meat, it can be concluded that the matrix of growth gives equally good results in forecasting the average consumption of meat as the widely used trend method. As meat production should follow the same consumption, in order to maintain a balance in the market, the importance of this study is in the fact that the forecasted consumption can be the basis for planning the production volume of appropriate kinds of meat, which would prevent any shortages and sudden price changes.

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Spatial Distribution Modelling of Juvenile Common Pandora (*Pagellus erythrinus* Linnaeus, 1758) in Relation to Habitat in the Shallow Waters of Gökçeada Using GIS

Semih Kale[1], Aytac Altin[2], Hakan Ayyildiz[3], Ozcan Ozen[4]

[1]Department of Fishing and Fish Processing Technology, Faculty of Marine Sciences and Technology, Çanakkale Onsekiz Mart University, Çanakkale, Turkey, e-mail: semihkale@comu.edu.tr
[2]Department of Fisheries Technology, Gökçeada School of Applied Sciences, Çanakkale Onsekiz Mart University, Çanakkale, Turkey, e-mail: aytacaltin@gmail.com
[3]Department of Fisheries Technology, Gökçeada School of Applied Sciences, Çanakkale Onsekiz Mart University, Çanakkale, Turkey, e-mail: h_ayyildiz@comu.edu.tr
[4]Department of Marine Technology Engineering, Faculty of Marine Sciences and Technology, Çanakkale Onsekiz Mart University, Çanakkale, Turkey, e-mail: oozen@comu.edu.tr

Abstract. The distribution of juvenile *Pagellus erythrinus* (Linnaeus, 1758) species was studied by the abundance, density and habitat preferences in the shallow waters of Gökçeada. Fish samples were obtained in experimental beach seine and beam trawl surveys carried out between 2013 June to 2014 May in the shallow waters of Gökçeada. To understand the habitat preferences of the species, sediment samples were collected and sediment composition was determined by grain size distribution analysis. The spatial distribution of juvenile *Pagellus erythrinus* species in relation to the habitat structure was estimated and modelled using Geographic Information System (GIS) and geostatistical tools. It was observed that juvenile *Pagellus erythrinus* species prefer the rocky areas which in 5-10 m water depth in the shallow waters of Gökçeada.

Keywords: Distribution, Juvenile, *Pagellus erythrinus*, Modelling, Gökçeada, GIS.

1 Introduction

Fish species which belong to the Sparidae family are important marine resources that play an important role in demersal fish community (Gomes et al., 2001) for fisheries and they are widespread in the Mediterranean Sea (Gordoa and Moli, 1997). Common pandora (*Pagellus erythrinus* Linnaeus, 1758) is a demersal species (Fischer et al., 1987) occurring to 220 m water depth (Russel, 2014) and the juvenile individuals are common near to the coastline (Ardizzone and Messina, 1983, Papaconstantiou et al., 1988) and has high commercial value in the Mediterranean coasts and distributes along the coasts of the central eastern and northeastern Atlantic

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Ocean (Bauchot and Hureau, 1986; Sanches, 1991) and the Mediterranean Sea (Bauchot, 1987). Some various aspects of the common pandora such as biology, feeding ecology, distribution, life history and fisheries have been previously studied (Zei and Zupanovic, 1961; Hashem and Gassim, 1981; Ardizzone and Messina, 1983; Ünsal, 1984; Andaloro and Giarritta, 1985; Girardin and Quignard, 1985; Papaconstantinou et al., 1988; Livadas, 1989; Mytilineou, 1989; Santos et al., 1995; Gonçalves et al 1997; Özaydın, 1997; Pajuelo and Lorenzo, 1998; Benli et al., 2001; Somarakis and Machias, 2002; Hoşsucu and Türker, 2003; Abecasis et al., 2008; Coelho et al., 2010; Fanelli et al., 2011). It can be found in various bottoms such as rock, gravel, sand and mud (Russel, 2014). Habitat preference of a species may change spatially and temporally for each life stages of the fishes (Crec'hriou et al., 2008). The relationship between environment and species can change because of the several factors (i.e. fish behavior, oceanographic characteristics). To understand how they can be affected, the habitat mapping offers a chance (Koubbi et al., 2006).

In this study we aimed to determine habitat preferences and to model the spatial distribution of juvenile *Pagellus erythrinus* species. Surveys were conducted in the shallow waters of Gökçeada Island (the northern Aegean Sea, Turkey). We combined geostatistical tools and GIS to model the spatial distribution of juvenile fish species in relation to the habitat structure.

2 Material and Methods

2.1 Study Area

Gökçeada was located in the northern Aegean Sea between 25°65' – 26°05' E and 40°05'–40°25' N (Fig. 1). The study area encompasses the shallow waters of Gökçeada between 0-20 m water depths.

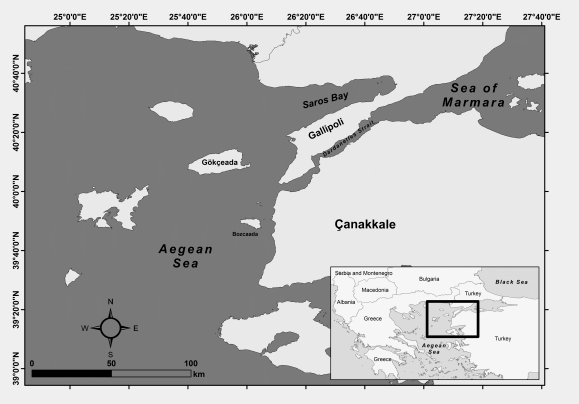

Fig. 1. The study area.

2.2 Sampling and Data Collection

Fish Sampling

Fish samples were collected in experimental beach seine and beam trawl surveys carried out in 6 different stations and 3 different water depth (0-2 m, 5-10 m and 10-20 m) between 2013 June to 2014 May in the shallow waters of Gökçeada (Fig. 2).

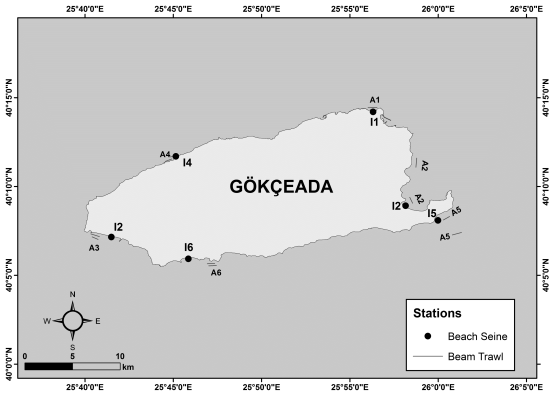

Fig. 2. Fish sampling stations (*A: Beam Trawl; I: Beach Seine*)

Sediment Sampling

Sediment samples were collected with a 0.1 m^2 van Veen grab at the sampling stations (Fig. 3). The collections of grabs in the stations were stored in sealed plastic bags until the analysis. Then sediment samples were dried at 105°C for 24 hours in an oven (Yee et al., 1992). Granulometry analysis was conducted for determining the sediment grain size and quantity. Data were analyzed for the characterization of the bottom sediment as the percentages of gravel, sand and mud (Folk, 1954).

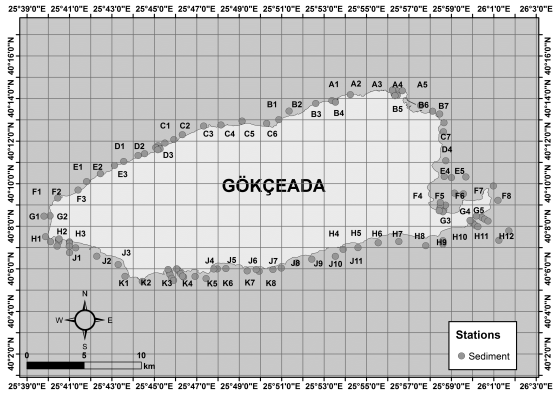

Fig. 3. Sediment sampling stations (Study area was divided into the grids which 1x1 min latitude and longitude and the grids were labelled from the North to the South alphabetically and from the West to the East numerically).

3 Results

The habitat structure was classified and modelled in the shallow waters of Gökçeada Island (Fig. 4). GIS and geostatistical tools were used to model species potential distribution in relation to habitat.

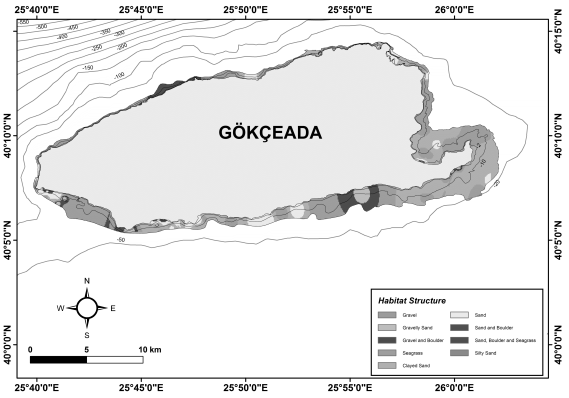

Fig. 4. The habitat structure in the shallow waters of Gökçeada Island.

The distribution and density of juvenile common pandora species were estimated considering the water depth and also modelled. The density of juvenile common pandora fish species was predicted as 2794.67 fish/km^2, 29757.39 fish/km^2, and

13022.74 fish/km^2 for 0-2 m, 5-10 m and 10-20 m water depth, respectively (Fig. 5). The density was found the highest in 5-10 m water depth, and the lowest in 0-2 m water depth. It is observed that juvenile common pandora species prefer the rocky areas in 5-10 m water depth. Also the species were observed in rocky areas and seagrass beds in 10-20 m and rarely sandy areas in 0-2 m water depth in Gökçeada shallow waters.

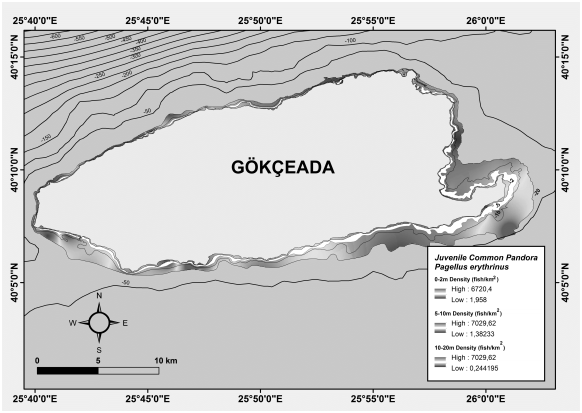

Fig. 5. The density and spatial distribution of juvenile common pandora on suitable habitats

4 Discussion

Habitat structure is one of the key issues that describe the changeability of Mediterranean fish assemblages (García-Charton and Pérez-Ruzafa, 2001; García-Charton et al., 2004). Bauchot ve Hureau (1990) notified that *Pagellus erythrinus* lives in the rocky, sandy, muddy bottoms and seagrass beds in 0-150 m water depth. The results of this study showed that the juvenile common pandora species occur in the shallow waters and prefer the rocky areas, seagrass beds and rarely sandy bottoms in the shallow waters of Gökçeada Island. This species would prefer these habitats for feeding, sheltering and nursery grounds in the shallow waters due to those waters are warmer than the deeper, are very rich in terms of food and the juvenile species are vulnerable during early life stages. Also, it is high commercially valuable fish species in this area.

Shallow waters are important areas for juvenile fish species in terms of recruitment and fisheries management. (Gibson et al., 1996; Harris and Cyrus, 1996; Nash and Santos, 1998; Layman, 2000; Polte et al., 2005). Most of fish species use these areas during early life periods for sheltering, feeding and nursery area. Beck et al. (2001) stated that a nursery habitat must support further additives to the adult recruitment about density, growth, survival of juveniles and movements to the other adult habitats. The assessment of species distributions and habitats is one of the

essential elements to develop comprehensible marine strategies (European Commission, 2010). GIS makes available new approaches for the more data processing with the integration and management of fishing survey data. Main existence areas of the species can be determined by the integration of fishing survey data with bathymetry (Valavanis et al., 2004). To ensure sustainable recruits and maintain the spawning stock, technical measures such as regulations of fishing gears and methods or area and time restrictions would be required. Pajuelo and Lorenzo (1998) recommended to apply the regulations of fishing gears and methods for ensuring that species is not targeted through the short spawning period. Also, monitoring the population should be continued (Russel, 2014).

5 Conclusion

This study provides new information on the spatial and bathymetric distribution of *P. erythrinus* in the Aegean Sea, eastern Mediterranean Sea. The spatial distribution, abundance and density of *P. erythrinus* was mapped to show possible distribution of juvenile species on suitable habitats. The bathymetric pattern of abundance and density showed a decrease at 0-2 m water depth. The density was found the highest in 5-10 m water depth. It is observed that juvenile common pandora species prefer the rocky areas in 5-10 m water depth in the shallow waters of Gökçeada Island.

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Investigation of Dairy Cattle Traits by Using Artificial Neural Networks and Cluster Analysis

Hülya Atıl[1], Asli Akilli[2]

[1]Department of Biometry and Genetic, Faculty of Agriculture, Ege University, Izmir, Turkey
[2]Department of Biometry and Genetic, Faculty of Agriculture, Ahi Evran University, Kirsehir, Turkey

Abstract. Artificial neural networks is a method which based on artificial intelligence, has been emerged according to the working principles of the human brain nerve cells. Especially in the modelling of nonlinear systems, with the information learned through experience similarly to humans, it provides classification, pattern recognition, optimization and allows the realization of forward-looking forecasts. Artificial neural networks is very successful method that has been the subject of many studies in different disciplines. Artificial neural network studies performed in animal husbandry in recent years, often located in the literature such as prediction of yield characteristics and classification, animal breeding, quality assessment, disease diagnosis. In this study, classification according to some traits of dairy cattle using artificial neural networks and k-means method are aimed. Due to results of the research, it is determined that artificial neural networks is more successful than the k-means clustering method. The analysis of study was performed using SPSS 20.0 statistical software package and Matlab R2011b work programme.

Keywords: Classification, artificial neural network, dairy cattle.

1 Introduction

One of the key issues in the field of animal breeding studies is classification differences and similarities measure with respect to each other to various characteristics of the animals. The animals' correct classification which made by the yield property or exterior features provide great advantages manufacturer and farmers.

Conscious breeding work, to be derived from animals is to maximize the level of economic benefits expected in herd management, which plays an important role in maintaining a profitable production. The aim of classification of animals is getting homogeneous in itself, themselves a heterogeneous group. Some of the statistical methods are known as cluster analysis, fuzzy clustering analysis, fuzzy logic, neural networks, and data mining methods used to make classification or clustering for this purpose in farming.

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Artificial neural network method is one of the performing machine learning methods based on artificial intelligence. Problems encountered in daily life vary under different conditions. This parallel opposite problem, combined with advances in technology, new methods of solution are produced. Artificial intelligence technologies provide great benefits to the people across the problem way to find a solution on the basis of the system created. Although it is fairly widely used, especially engineering, medicine, agriculture areas etc. artificial neural network is frequently used in recent years. Artificial neural networks is a method that have emerged to move the workings of nerve cells in the human brain. People likewise, it can perform functions such as optimization, prediction, classification, pattern recognition using information learned through experience based on the data. It is very successful method that located in linear and non-linear system the relationship between input and output variables mathematical modelling, in many cases according to conventional statistical methods with low error rates obtained from the analysis results (Takma et al. 2012; Akıllı and Atıl 2014).

In animal science artificial neural network is successfully applied such as diagnosis of diseases such as mastitis and lameness (Yang ve ark. 1999; Cavero et al. 2008; Sun 2008; Hassan et al. 2009; Roush et al. 2001), in the prediction of the forward-looking traits (Grzesiak et al. 2003; Salehi et al. 1998; Sanzogni and Kerr 2001; Kominakis et al. 2002; Hosseinia et al. 2007; Görgülü 2012), animal breeding studies (Shahinfar et al. 2012; Salehi et al. 1997; Grzesiak et al. 2010), in the prediction of the nutrient content in manure (Chen et al. 2008; Chen et al. 2009; Chen et al. 2009) and oestrus detection (Krieter et al. 2006).

In this study, it is aimed using artificial neural networks and k-means clustering method in the framework of the identified variables divided into homogeneous groups of dairy cattle.

2 Material and Method

2.1 Material

The study material consists of records related to 10,000 head of Holstein Friesian dairy cattle for milk, fat and protein yield values with calving interval, age at first calving, milking days and season variables that obtained between 1981-2000 years. Data analysis was carried out using SPSS 20.0 statistical software package programme and MATLAB (R2011b) programme.

2.2 Method

In this study, artificial neural network and k-means clustering method which is one of multivariate statistical methods are used for classification according to the specified characteristics of dairy cattle.

Cluster analysis provides in itself homogeneous and between them heterogeneous group separation unable to obtain precise information about the studied data group

data sets taking into consideration the differences and similarities in that they showed against each other. Cluster analysis is being implemented in three phases such as creation of data matrix, selection of the clustering technique and discussion of the significance of the results (Tatlıdil 1996; Alpar 2011).

In this study, k-means method is used which is one of non-hierarchical clustering methods. In this technique, it is not necessary to determine the similarity and distance matrix. However, it should be noted by the researchers of a possible cluster number (Özdamar 2010). Standardized data variables are used because of having different scale and size value the variables examined in the study. The data is converted to a standard value Z scores [$Z \sim N(0,1)$]. Formula used for this purpose is located in Equation 1 (Kalaycı, 2008).

$$z = \frac{(x-\mu)}{\sigma} \tag{1}$$

In k-means technique, observations divided into k clusters including the smallest sum of squares within clusters as shown in Equation 2.

$$W_n = \frac{1}{n}\sum_{i=1}^{n} \min_{1 \le j \le k} \left\| x_i - a_{jn} \right\|^2 \tag{2}$$

According to the rule the observation of classification takes place in the nearest cluster. In the rule; each one x_1, $x_{2,}$...,x_n determined number of variables for each observation vector set, a_1, a_2.....a_{kn} each group were selected as cluster centres for individuals (Tatlıdil, 1996).

The second method is a method used in the study neural networks. Artificial neuron with a similar operating principle biological nerve cells form a neural network together. Artificial neuron consists of different numbers of inputs and outputs. Inputs pass through the activation function with a sum function to collect information from the outside and generate output. The generated output is transferred to another cell via links to have the neural network (Öztemel, 2006; Negnevitsky, 2001). The comparative view of the biological and neural cells is located in Table 1.

Table 1. Biological neuron and artificial neuron

Biological Neuron	Explanation	Artificial Neuron
Neuron	Nerve cell	Processor element
Axons	One-way transmission of information	Outputs
Dendrites	Receiving the information	Inputs
Synapse	Communication between nerve cells	Weights

Artificial neural networks, is composed of input- output layer and one or different number of hidden layers in between the layers. Received data from the input layer is processed in the hidden layer and then sent to the output layer. Determining the weight value concerning the training of the network that allows nerve cells in neural

networks is an important process. Severity of incoming data is decisive here. Determining the proper amount of weight, it means to make accurate generalizations to do right never seen through examples and thereby create new information. The data of the input variables are converted to output values in the output layer being associated with weight values (Negnevitsky, 2001; Baykal and Beyan, 2004; Öztemel, 2006; Russel and Norvig, 2010; Uğur and Kınacı, 2006).

The studies related to neural networks have led to the emergence of different network structures according to the different problem structure. In the literature, the most commonly used networks single and multilayer perceptrons, vector quantization models (LVQ), self organized map (SOM), adaptive resonance theory (ART), Hopfield network, Elman network, radial basis function network (Öztemel, 2006). Artificial neural networks are classified as feed forward networks, and feedback networks depending on the direction of information flow. Also it is classified according to different learning strategies such as supervised, unsupervised and reinforcement learning. View of the multi-layered artificial neural network is located in Figure 1.

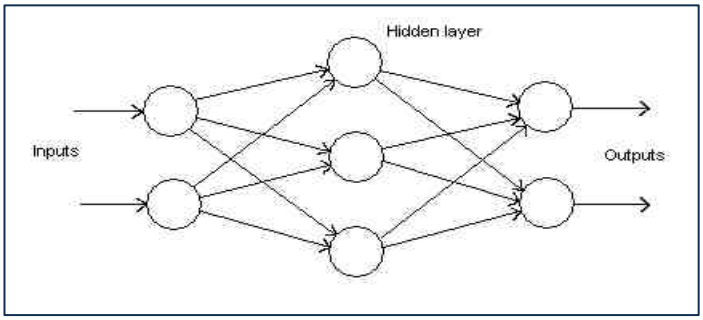

Fig. 1. Multilayer perceptron artificial neural network.

This neural network model used in this study is defined as multilayer perceptron. Multi-layered sensor model operates according to the supervised learning strategy and it has feed forward terms of the direction of flow of information structure. This learning algorithm used in the multilayer perceptron model is designed to work as back-propagation algorithm. Back propagation algorithm operation is performed in two basic stages. The data of the input variables in the first stage is presented to the neural network, in next stage after the processing of data weight in each layer based on the error level is updated on the resulting output and in order to minimize error, the spread of error is provided backwards from the output layer. Levenberg-Marquardt algorithm, which is the back propagation algorithm, the problem structure in this study to investigate suitability, is preferred because the learning error and low running faster than other algorithms.

The number of processor elements in each layer and number of layers in the network structure acts in substantially the operating performance of artificial neural networks. In literature, a specific formula for determining the number of layers and the processor element is not included. In this study, the numbers of processor

elements and layer were determined using detailed literature study for research and trial and error with the heuristic.
Perform the clustering process with the lowest error which layer and the processor element number is determined as the optimal number. Performance criteria used for this, it was determined as the coefficient of determination (R^2), the root mean square error (RMSE), mean absolute deviation (MAD) and mean absolute percentage error (MAPE). According to these criteria with high value R^2 and error variance expressing the low value of RMSE, MAD and MAPE statistics is the low value indicated that the best fit of the model which is the subject of research. R^2, RMSE, MAD and MAPE for the calculation of statistical formulas is located in respectively Equation 3-6. In equations n: number of records, Y_i: observed value, $\hat{Y}_i$: predicted value.

$$R^2 = \frac{\sum_{i=1}^{n} (\hat{Y}_i - \overline{Y})^2}{\sum_{i=1}^{n} (Y_i - \overline{Y})^2} \tag{3}$$

$$RMSE = \sqrt{\frac{\sum_{i=1}^{n} (\hat{Y}_i - \overline{Y})^2}{n}} \tag{4}$$

$$MAD = \frac{\sum_{i=1}^{n} \left| Y_i - \hat{Y}_i \right|}{n} \tag{5}$$

$$MAPE = \frac{\sum_{i=1}^{n} \left| \frac{Y_i - \hat{Y}_i}{Y_i} \right|}{n} \times 100 \tag{6}$$

The data are subjected to normalization pre-processing prior to analysis done by the method of artificial neural networks. Normalization process network to reduce the difficulties during the training is done in order to run faster in the training process of the network and the balancing of the importance of the parameters involved in research. In the literature different types of normalization techniques are located. Researchers are different techniques depending on the problem structure may choose (Öztemel 2006; Xu et al, 2007; Jayalakshmi and Santhakumaran, 2011). In this study data [0.1-0.9] range is scaled using the formula in the Equation 7 (Xu et al, 2007).

$$P_n = 0.1 + (0.9 - 0.1) \times \frac{(P - P_{\min})}{(P_{\max} - P_{\min})} \tag{7}$$

In Equation 7, P_n contained in the data set represents the normalized value as a value P. $P_{\max}$ and $P_{\min}$, located in the input or output variable indicates the data set having the highest and lowest values of the data. After the normalization process is complete the minimum value of 0.1 and the maximum value of 0.9 is determined in the data set. After network training is completed and the test output data obtained to convert the actual scale of the output, the formula was used in the Equation 8. In next step, made a comparison between the predicted value and actual value and performance criteria is calculated.

$$P = (P_n - 0.1) \times \frac{(P_{\max} - P_{\min})}{(0.9 - 0.1)} + P_{\min} \tag{8}$$

P represents the converted value that is transformed pre-normalization.

Before starting the analysis with neural networks dataset completely randomized on the 80% training and 20% testing data set is divided into two different groups namely. 8,000 head of dairy cattle in the training data set and test data set consists of records pertaining to 2,000 head of dairy cattle milk production traits variable.

In this study, a detailed literature review for research and using trial and error, layers and the number of processor elements are determined. Prediction performs operations with the lowest error layer and the number of processor elements has been identified as the most appropriate number. Number of hidden layers is "1" and the number of neuron in this layer is "7" are determined in the neural network designed study. Also, convergence criteria and maximum number of iteration has been recognized as $1x10^{-6}$ and 1000. Animals which have been the subject of research were clustered before analysis by an expert. The methods' performance was evaluated with the expert opinion. The inputs of model are defined as first calving age model, calving interval, milk with milking day data, the value related to fat and protein yield. The output of the model refers to the group to which it belongs to the subject of dairy cattle research.

3 Results and Discussion

In this study, artificial neural networks, k-means clustering method based on 10,000 head of dairy cattle milk production traits is divided into homogeneous groups. In the result of analysis, animals were included in three different groups. Analysis of the results of artificial neural networks is located in Table 2. According to the results of highest classification success in the case where the number of neurons is provided seven. Here, the neural network which has seven neurons is observed that coefficient of determination of 99.9% and lower levels of error statistics according to the number of other neurons.

Table 2. Artificial neural network test results working with different numbers of neuron.

Neuron Number	R^2	RMSE	MAD	MAPE
4	99.9%	1.7603	0.08115	0.0048
5	99.9%	1.7603	0,08114	0.0017
6	99.9%	1.7601	0,08113	0.0106
7	**99.9%**	**1.7599**	**0,08108**	**0.0177**
8	99.7%	1.7595	0,08104	0.0088
9	99.8%	1.7594	0,08103	0.0513
10	99.9%	1.7602	0.08114	0.0053

The neural network and k-means method is situated classification performance in Table 3. The method used in the classification process seems to be quite successful relating to dairy cattle. The results indicate that the more successful classification by the k-means method of artificial neural network method.

Table 3. Artificial neural network and K-means results.

Statistics	ANN	K-means
Coefficient of determination	99.9%	94.9%
RMSE	1.7599	1.7758
MAD	0,08108	0.0002
MAPE	0.0177	0.1048

Artificial neural network and k-means method is located performance values of conformational display in Figure 2.

Classification works done by artificial neural networks are quite common in the livestock area. Hassan et al. (2009) a neural network model used for the detection of mastitis and analysis resulted in success in their study. A like, Yang et al. (2000) in the estimation of clinical mastitis cases with milk production traits studied the availability of artificial neural networks. The study of comparative review of artificial neural networks, Grzesiak et al. (2003) in their study, multiple regression and artificial neural networks methods have used to estimate the 305-day lactation milk yield. Takma et al. (2012), lactation milk yield of Holstein were modelled using multiple regression and neural network. In both studies it noted that the comparison of the results artificial neural networks can be an alternative method to regression analysis.

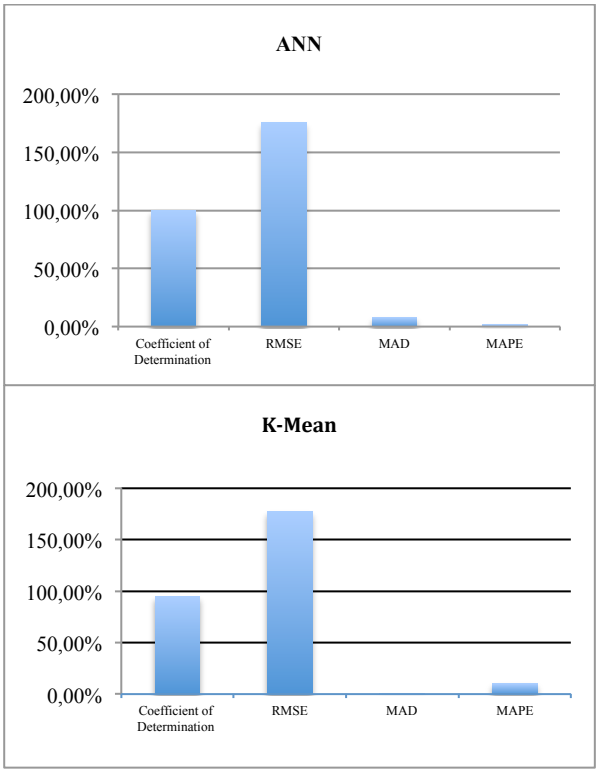

Fig. 2. Artificial neural network and K-means method results

In this study, artificial neural networks and k-means clustering methods were examined in comparison to their classification and such as mentioned in recent studies methods artificial neural networks that provide very good results.

4 Conclusion

In this study, k-means clustering method and the method of artificial neural networks are used for classification of dairy cattle. When the k-means clustering method and artificial neural network method of classification performance comparison, the neural network is seen as a better fit. The survey results indicate neural networks can be used as an alternative to clustering analysis of animal science methods. Artificial neural network -the machine learning perform and one of the artificial intelligence methods- provide a lower estimate convenience incorrect classification according to the traditional method for researchers. Classification work done by artificial neural networks in the field of animal science in the literature is quite low. In the later stages of this study it is intended to be resources for individuals to do research on this subject. Different neural network models and different input

variables with in studies are expected to give positive results in the classification of animals.

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Conditions of Hooks After Fishing Operation Used on Bottom Longlines in Çanakkale Region (Northern Aegean Sea)

Alkan Öztekin[1], Uğur Özekinci[2]

[1]Çanakkale Onsekiz Mart University, Faculty of Marine Sciences and Technology, 17100, Çanakkale, Turkey, e-mail: alkanoztekin@comu.edu.tr
[2]Çanakkale Onsekiz Mart University, Faculty of Marine Sciences and Technology, 17100, Çanakkale, Turkey, e-mail: uozekinci@comu.edu.tr

Abstract. This study was conducted for determining the conditions of hooks after fishing operations in May 2011 – June 2012 on the coasts of Dardanelles Strait and Gallipoli Peninsula. Twenty longline operations with three replication were carried out between 5 and 500 m sea depth. Each longline consisted of 200 hooks. 60000 m of fish line was outspread with a total of 12000 hooks and a total of 1360 individuals were sampled. In the present study; after fishing operation, conditions of hooks were recorded according to status of hook (caught or broken off) and bait (with bait, without bait or bitten). Five different conditions of hooks were identified which are caught (8,62%), broken off (8,19%), with bait (28,71%), without bait (48,02%) and bitten (6,45%).

Keywords: Dardanelles, bottom longline, hook, catch

1 Introduction

Northern Aegean Sea has a wide continental shelf, muddy and sandy bottom structure, and rich nutritious elements (Maravelias and Papaconstantinou, 2006). Compared with the Southern Aegean Sea; it has much more phytoplankton and zooplankton (Theocharis et al., 1999). Northern Aegean Sea is extremely important fishing area due to the most intensive fish migration along the coast of Turkey. Longlines are preferred because of its low fuel consumption and eco-friendly structure beside of using in fishing (Endal, 1979; Bjordal, 1988; Lokkeborg and Bjordal, 1992).

Longlines are the fishing gear commonly used in bottom fish species fishing. Better results were observed in bottom fish species fishing with longlines because of covering the large areas and slow and limited movements of bottom fish species (Alpbaz and Özer, 1996). Also, longlines can be easily removed by marking in case of any disappearance while fishing operation or later. Because of this; it gives less damage to marine ecosystems compared with fishing nets, trawlers and purse seiners.

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However, it is known that longlines have the minimum level of ghost fishing in passive fishing gears. The present study aimed to identify the after fishing conditions of different sizes hooks used on bottom longlines in Northern Aegean Sea and provide resource information to fisheries management authorities.

2 Material and Method

The present study was conducted in May 2011 – June 2012 on the coasts of Dardanelles Strait and Gallipoli Peninsula between 5 and 500 m sea depth in the commercial fishing area (Figure 1). Longlines used in trials were prepared based on same dimensions with the longlines of commercial fishermen (Figure 2).

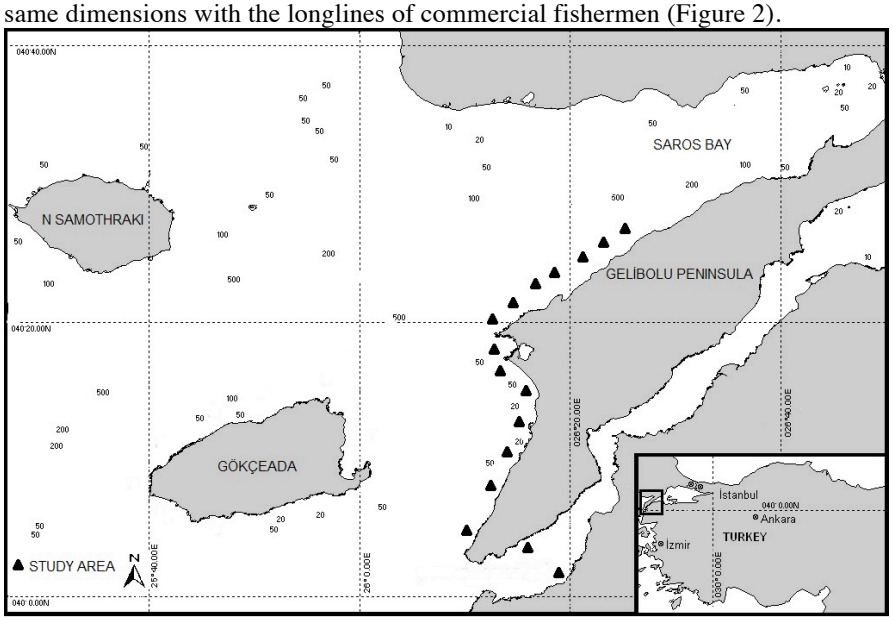

Fig. 1. Study Area

The mainline length of bottom longline is 1000 mm, diameter is 1.20 mm and made of monofilament fishing line. The snood is 1 m long and 0.80 mm in diameter. Each snood is connected the mainline with an interval of 4 meters. According the status of stream, stones were attached to mainline between every twenty or thirty snood to gain weight. VMC 9747 PS branded, number 8, 10, 12, 14 thick type, flat hooks were used in longlines. Longlines were left in the sea straight or zigzag shape. Longlines were usually left in the sea in early morning times or night times if the weather is suitable, and removed back after waiting nearly 12 hours.

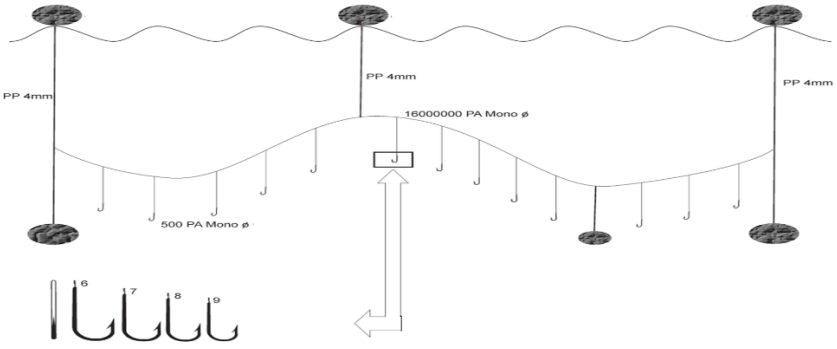

Fig. 2. General schema of longlines used in study.

3 Results

In trials, 60000 m of fish line was outspread with a total of 12000 hooks and 60 longline baskets was used in total. After removing back from sea, hooks were evaluated according to condition, (caught, broken off, with bait, without bait or bitten).

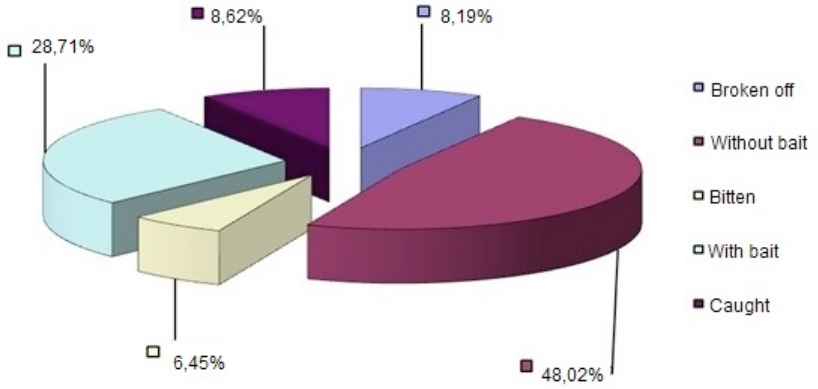

Fig. 3. Conditions of hooks after fishing operations

After fishing operations, 76,73% of hooks were found with bait or without bait and 8,19% of hooks were broken off because of stones or bitten by big fish. 8,62% of hooks were caught fish successfully. 4,48% of this successfully caught amount were by-catch and discard species. In 6,45% of hooks which is the lowest value of records, baits on the hooks were bitten.

4 Discussion

Longlines should be developed to more efficiency for being alternative to other fishing gears using in the coastal fishing area because of its minimum damage level to marine ecosystem compared other fishing gears, low costs and selectivity properties can be easily set for the target species and sizes. Catching target species and sizes by chancing size and shape of hooks is one of the factors which affects the selectivity (Öztekin et al., 2012). Therefore, hook selection for the target species is extremely important. In addition, specific fishing gears and methods that are less harmful to ecosystem should be supported and developed for protection of the endangered marine species protected under international conventions (Öztekin et al., 2014).

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Impacts of High Concentration of CO_2 on the Serum Biochemistry and Carbonic Anhydrase Enzyme Activity of Rainbow Trout, *Oncorhynchus mykiss*

Sevdan Yılmaz[1], Hasan Kaya[2], Mert Gürkan[3], Olcay Hisar[2], Kahraman Selvi[4], Selçuk Türel[1], Bilal Aydın[5], Samet Çetin[5]

[1]Department of Aquaculture, Faculty of Marine Sciences and Technology, University of Çanakkale Onsekiz Mart, Turkey, e-mail: sevdanyilmaz@comu.edu.tr
[2]Department of Basic Science, Faculty of Marine Sciences and Technology, University of Çanakkale Onsekiz Mart, Turkey
[3]Department of Biology, Faculty of Art and Science, University of Çanakkale Onsekiz Mart, Turkey
[4]Yenice Vocational Collage, University of Çanakkale Onsekiz Mart, Turkey
[5]Natural and Applied Sciences, University of Çanakkale Onsekiz Mart, Turkey

Abstract. In this study, the physiological effects that the increasing carbondioxide concentrations on rainbow trout, *Oncorhynchus mykiss* is evaluated by using serum biochemical variables and carbonic anhydrase activities. The fish were exposed for 14 days to 14 mg/L concentrations of CO_2. The serum GLU value showed a significant increase in the group exposed to CO_2 compared to the control group at days 14. Serum TRI, COL and blood CA values showed a significant decrease in the group exposed to CO_2 at day 7 compared to the control group. The TRI value a statistically significant increase in the group exposed to CO_2 at day 14 compared to the control group. In conclusion, this study results indicate that the some serum biochemical variables and blood carbonic anhydrase activity of rainbow trout significantly affected by high level of CO_2.

Keywords: *Oncorhynchus mykiss*, carbondioxide, blood, carbonic anhydrase

1 Introduction

It is now recognized that the 21st century will show a significant global warming trend induced by an increase in atmospheric greenhouse gases (Houghton et al., 2001). Carbon dioxide (CO2), one of the important green gases, has increased by 40% from pre-industrial levels from approximately 280 parts per million by volume (ppmv) in the 18th century to 390 ppmv in 2010 (IPCC 2007). Water sources are attractive sites for possible storage of CO2. Addition of CO2 to the water will result in a decrease in pH due to the bicarbonate buffer system in sea- and fresh-water. It is supposed that disposal of sufficient CO2 to stabilize atmospheric levels at twice the pre-industrial level by the end of this century would lower the pH of the entire water

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sources on average by more than 0.1 units (Caldeira and Wicket 2003). Addition of CO2 to the water will result in a decrease in pH due to the bicarbonate buffer system in seawater and freshwater. This is a large fraction of the normal variation of pH in open water sources. Research interest in CO2-driven water acidification has been centred on certain groups of calcifying water organisms, but knowledge on the possible impacts of water acidification on fish is limited.

The purpose of the present study was to evaluate the impact of high water CO2 levels (14 mg/L) in freshwater on serum biochemical variables and carbonic anhydrase activities in rainbow trout, Oncorhynchus mykiss for 14 days.

2 Material and Method

The experiment was designed in triplicate and 12 fish were placed in each experimental tank (140 L). During the experiment, the fish were exposed for 14 days to 14 mg/L concentrations of CO2 by injecting CO2 (purity 99.9%) gas by means of ceramic diffusers. Control group was not exposed to CO2. In the experiment, five fish from each aquarium on the 7th and 14th day were used for analysis. The serum biochemical variables (glucose, total protein, albumin, triglyceride and cholesterol) in the blood serum was measured according to Yılmaz et al (in press). The CO2 hydratase activity of the CA enzyme was assayed colorimetrically by using the method of Wilbur and Anderson (1976). Each value was expressed as mean ± standard error (SE) for each parameter measured. Student's t-test was used to determine the significance of differences between the exposure group and control group. The statistical analyses were carried out by using SPSS 17.0, and the significance level was considered to be 0.05.

3 Results

In the present study, results (Table 1) showed that CO2 exposed group did not show differences of Tprot, ALB and GLO values at any of the two sampling periods as compared with the control group ($P>0.05$). However, the serum GLU value showed a significant increase in the group exposed to CO2 compared to the control group at days 14 ($P<0.05$). Serum TRI, COL and blood CA values showed a significant decrease in the group exposed to CO2 at day 7 compared to the control group ($P<0.05$). The TRI value a statistically significant increase in the group exposed to CO2 at day 14 compared to the control group ($P<0.05$).

Table 1. Effect of exposure to CO_2 on serum biochemical, blood pH and carbonic anhydrase activity (EU/mg Hemoglobin) in rainbow trouts

	7 th day		14 th day	
	Control	Control+CO_2	Control	Control+CO_2
GLU (mg/dL)	58.20±4.64	50.66±4.24	64.19±2.48	80.12±5.44*
Tprot (g/dL)	3.18±0.30	2.71±0.20	2.53±0.10	3.13±0.30
ALB (g/dL)	0.60±0.05	0.52±0.04	0.59±0.03	0.56±0.06
GLO (g/dL)	2.57±0.25	2.20±0.16	1.95±0.10	2.56±0.25
TRI (mg/dL)	31.81±3.25	18.32±1.90*	23.51±1.08	46.13±3.45*
COL (mg/dL)	125.28±10.51	72.76±6.11*	132.72±3.55	138.80±9.74
Blood CA	146.69±14.41	55.90±17.12*	158.97±13.50	167.92±29.82

The asterisks in same experimental days indicate significant differences between the control and CO2 groups ($P < 0.05$).

4 Conclusion

Measurement of blood parameters can indicate the welfare status of fish (Roncarati et al 2006). The CO2 reactions within the RBC are catalyzed by carbonic anhydrase (CA) (Swenson and Maren 1987). The rapid anion exchange mechanism therefore facilitates the loading of CO2 into the blood at the tissue level and provides plasma $HCO3^-$ with access to CA during the short period that blood passes through the gills (Currie et al 1995). As a result of the study, it is identified that CO2 concentrations cause negative effects on the serum glucose, triglyceride, cholesterol and blood carbonic anhydrase activity. In conclusion, this study results indicate that the some serum biochemical variables and blood carbonic anhydrase activity of rainbow trout significantly affected by high level of CO2.

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Session 10: IT Applications of Health & Farm Management

Environmental Impact in Process Tomato Integrated Production

Efthymios Rodias[1], Eleftherios Evangelou[2], Vagis Samathrakis[3], Ourania Notta[4], Dimitrios Aidonis[5], Dionysis Bochtis[6]

[1]Technological Educational Institute of Central Macedonia, Department of Logistics, Katerini, Greece, e-mail: efthimisr@yahoo.gr
[2]Hellenic Agricultural Organization "DEMETER", Institute of Soil Mapping and Classification, e-mail: levagel@gmail.com
[3]Department of Accounting & Finance, Alexander Technological Educational Institute of Thessaloniki, Greece, e-mail: sbagis@acc.teithe.gr
[4]Department of Agricultural Technology, Alexander Technological Educational Institute of Thessaloniki, Greece, e-mail: ournotta@farm.teithe.gr
[5]Technological Educational Institute of Central Macedonia, Department of Logistics, Katerini, Greece
[6]Aarhus University, Department of Engineering - Operations Management, Inge Lehmanns Gade 10, 8000, Aarhus, Denmark, e-mail: dionysis.bochtis@eng.au.dk

Abstract. In modern agriculture, the energy that is consumed in every stage of production can be divided in direct (e.g. fuels and lubricants) and indirect (e.g. machinery embodied energy, materials and agrochemicals etc). This energy consumption can be examined further in environmental level as environmental impact. Environmental impact regards to the CO_2 that is emitted during the production process and contributes in a negative way to the environment. CO_2 can be emitted directly by fuels and lubricants that are used from tractors or other farm machinery and indirectly by any material application, machinery embedded energy and many other field inputs. In this paper, the environmental impact of industrial tomato production in kg of CO_2 per kg of product is analyzed and estimated. There is a range in the environmental impact in the 9 different case studies from 0.0606 to 0.1256 kg CO2/kg of tomato.

Keywords: energy, environment, CO_2, carbon footprint.

1 Introduction

It is crucial before the establishment of a perspective crop to evaluate the energy consumption and/or the environmental impact. The environmental impact can be estimated either as carbon footprint or as CO_2 emissions. Carbon emissions are connected directly to the energy consumption. Barber suggested that there is a direct relationship between energy and carbon content. Furthermore, analyses the main carbon indicators that are involved in agriculture process from different inputs (Barber A, 2004). Lal has estimated the carbon emission from different field operations (Lal R., 2004).

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It is important to evaluate crops regarding their carbon emissions and the environmental impact. Karakaya et al. are assessed the carbon dioxide emission during production of the fresh and the processed tomatoes (paste, peeled, diced, and juiced) (Karakaya and Özilgen, 2011).

In this paper, an estimation of the carbon dioxide emissions in industrial tomato integrated production process is examined, including both in-field and logistics operations in 5 case studies. Furthermore, the main carbon inputs are determined and assessed.

2 Materials and Methods

The main parameters-inputs to the examined system correspond to machinery, materials and fuels. Regarding the operations that taken into account in the presented system are the main operations implemented in the cycle farm-field, the in-field operations and those in the cycle field-factory. As computational tool, MatLab Mathworks© was used. A computational model was created to include and calculate all the carbon inputs with high accuracy. The model based on literature data, commercial sources and real farmers' data. The operations that implemented can be divided into the in-field operations and the logistics operations.

2.1 In-field operations

In-field operations can be divided depending on whether there is a material that is held (e.g. fertilization) or not (e.g. disk-harrow). In both cases, the input carbon elements that have to be estimated are the fuel and lubricants factor, the labor factor, and the machinery embodied factor, while in the case of material handling operations the material carbon factor has also to be estimated. The key factor for the former case is the working time in the field under question while for the latter case the key factor is the quantity of the material that is applied or placed in the field.

For each individual operation the estimation of the working time takes place. The working time of a field operation includes the effective in-field operation time (the time that a machine produce work) and the non-effective time (that includes times for loading/unloading - in the case of the material-handling operations, machinery adjustment and time that is allocated for headland turns). The relation between the effective and non-effective time is described by the term of "time efficiency", which represents the ratio of the time a machine is effectively operating to the total time the machine is committed to the operation (Hunt, 1995). Based on the time efficiency the field capacity (ha/h) can be estimated by taking into account also is calculated by using the operating speed (Km/h), the rated width of the implement (m), and a unit conversion factor. For the calculation of operational capacity data from ASABE standards for the field efficiency for each operation and the average operational speed are used (ASAE 2003).

For the fuel consumption estimation the equation provided in ASABE standards for the typical fuel consumption of an agricultural machine is used:

$2.64 + 3.91 - 0.203\sqrt{738X + 173}$ (l/KW h) (where X is the ratio of equivalent PTO power required by an operation to that maximum available from the PTO (ASAE 2003)). Using the fuel energy content (diesel for the particular case), the working time, the tractor power and the fuel emissions factor, the fuel emissions input is calculated for the particular field operation.

The lubricants consumption is estimated using the equation provided in ASABE standards for typical agricultural machinery diesel engines: $0.00059P + 0.02169$ (l/h) (ASAE 2003). Using the appropriate lubricants energy content, the working time, the power of the tractor and the lubricant emissions factor, the lubricants emissions input is calculated for the particular field operation.

Labor factor is taken into account that does not contribute to the total emissions calculation.

Embodied emissions factor regards the emissions that have been produced during the whole production process of each machinery system, tractor and implement. This factor, multiplied by each corresponding machinery weight, the total consumed emissions for the construction, transportation and maintenance of each farm implement's whole lifetime (from ASABE standards) will be extracted and using the working time the proportional embodied machinery emissions input for each field operation is calculated.

In the case of field operations involving material handling, beyond the above mentioned inputs, the material emission inputs (propagation means/ fertilizers/ agrochemicals) should be calculated also given their necessary quantity for each case and the emissions factor for the material production.

2.2 Farm-field transportation

The transportation cycle farm-field-field is taken into account in every field operation. The calculation of emissions produced for this transport varies if the operation that is going to be implemented includes material application (fertilizer, agrochemical, etc.) or not. In both cases the main inputs correspond to fuels, lubricants and embodied energy even though the parameters that are taken into account are different.

For material operations, in fuels emissions input estimation contribute the fuel energy content, the fuel consumption/trip, the number of trips, the wagon maximum volume (in case of planting), the tanker maximum weight (in case of fertilization and agrochemicals spreading) and the fuel emissions factor. In lubricants energy input estimation, the lubricant energy content, the tractor power, the number of trips, the distance farm-field, the average road speed are taken into account and the lubricant emissions factor. In embodied energy input contribute the embodied energy of tractor and wagon/tanker, their estimated lifetime, their weights, the number of trips, the distance farm-field, the average road speed and the embodied emissions factors.

On the other hand, regarding farm-to-field logistics operations that correspond to only machinery transportation, only one return trip per operation is taken into account in the cycle farm-field-farm and there is no material emissions input.

2.3 Field-Factory transportation

This transport regards the energy inputs during the transport of the harvested product from field to storage-processing facilities. In fuels emissions input calculation are taken into account the fuel energy content, the factor X, the tractor power, the in-field capacity of harvesting, the field area, the fuel consumption per trip, the number of trips the wagon full volume and the fuel emissions factor. Lubricants energy input calculation depends on the lubricant energy content, the tractor power, the in-field capacity of harvesting, the field area, the number of trips, the cycle time, the time needed to fill a wagon and the lubricant emissions factor. Regarding the embodied emissions inputs calculation is based on the embodied energy of tractor and wagon, their estimated lifetime, their weights, the cycle time, the time needed to fill a wagon, the in-field capacity of harvesting, the field area and the embodied emissions factor.

3 Results

Five case studies of industrial tomato farmers from Thessaly area in a whole production period were selected. The main figures of each case studies are shown in Table 1.

Table 1. Main figures in 5 case studies

	Area (ha)	Distance Farm-Field (km)	Distance Field-Factory (km)	Emissions Rate (kg CO2/kg product)
1	6.83	4	43.5	0.0606
2	3.24	4	57.1	0.0926
3	3.00	4.4	84.8	0.0910
4	2.48	6	14.3	0.0995
5	1.65	4.5	78.9	0.1256

Each field operation that is implemented from every farmer is examined and analyzed. It's taken into account that tomato is planted in small seedlings. The system boundary determined from the moment that tomato plants are planted until the final tomato product will be harvested and transported to the processing factory.

In Fig. 1 the total emissions consumption for the whole production process in 5 case studies is presented.

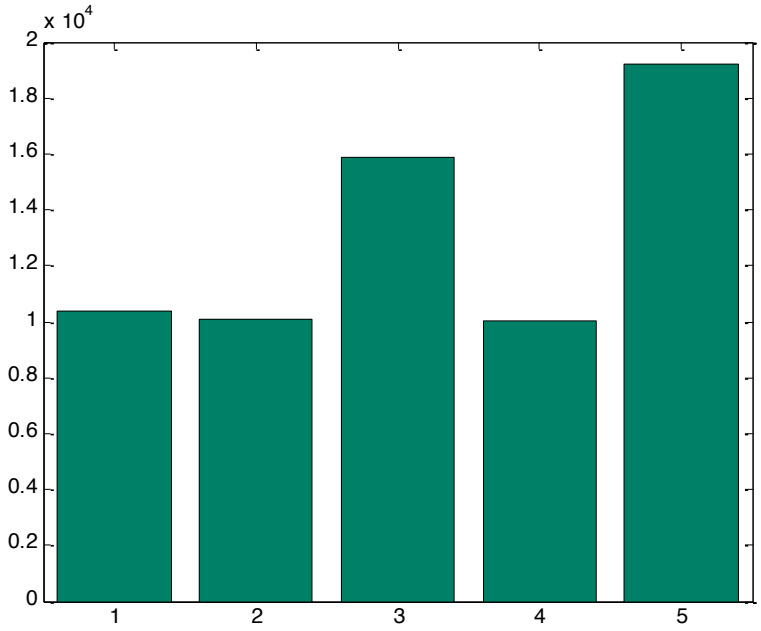

Fig. 1. Total emissions in kg CO_2 per ha for the 5 fields regarding the whole production process

In Fig. 2 the emissions produced for the different field operations in case study 1 is shown.

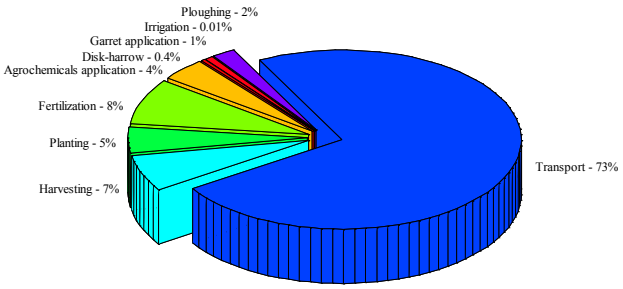

Fig. 2. Emissions per field operation in case study 1

4 Discussion

In this paper the assessment of CO_2 emissions produced during a whole production period in industrial integrated tomato fields was presented. Every field operation was analyzed under specific mathematical models in order that these field systems will be optimized in future. Finally, the total produced emissions per kg of produced product were extracted.

These results can be used in a wider research in emissions rate assessment for the total supply chain production - transport - industrial tomato processing - transport.

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Farm Management Information Systems

Nebojsa Novkovic[1], Christoph Huseman[2], Tihomir Zoranovic[3], Beba Mutavdzic[4]

[1]University of Novi Sad, PhD, Professor, Faculty of Agriculture, Trg Dositeja Obradovica 8, 21000 Novi Sad, Serbia, e-mail: nesann@polj.uns.ac.rs
[2]University of Novi Sad, PhD candidate, Faculty of Agriculture, Trg Dositeja Obradovica 8, 21000 Novi Sad, Serbia, e-mail: christoph.husemann@polj.uns.ac.rs
[3]University of Novi Sad, PhD, Assistant Professor, Faculty of Agriculture, Trg Dositeja Obradovica 8, 21000 Novi Sad, Serbia, e-mail: tihomir@polj.uns.ac.rs
[4]University of Novi Sad, PhD, Assistant Professor, Faculty of Agriculture, Trg Dositeja Obradovica 8, 21000 Novi Sad, Serbia, e-mail: bebam@polj.uns.ac.rs

Abstract. The fast changing environment, including difficult market conditions and a high exposure to financial risks are major reasons for changing production policy. Farm Management Information Systems (FMIS) appear to be a powerful tool to deal with the new conditions. However, farmers still rely more on their intuition than on proper management tools, when it comes to running a farm business. Many farmers do not use FMISs for various reasons, like lack of knowledge and the complexity of many available FMISs. In particular for small to medium-sized farms and for multifunctional farms appropriate FMISs hardly exist. The objective of this paper is to give a brief overview why modeling has not had its breakthrough in the farming sector so far.

Keywords: Farm Management Information System, Modeling, Management

1 Introduction

The skillful and accurate management of farms (Mishra et al. 1999; Muhammad et al. 2004) is one of the most important success factors for their effective functioning, their sustainable development and survival in today's fast changing environment (Forster, 2002).

The reasons why a sophisticated farm management is such an important and challenging task are certainly diverse, however, three major factors have been identified in the ongoing academic discourse (Inderhees 2006; Sørensen, Bochtis 2010):

1. A complex environment
2. Complex farm structures
3. The introduction of modern technologies to the agricultural sector (Glauben et al. 2006; Inderhees 2006; Sørensen, Bochtis 2010)

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Farms are involved in an environment, which has become more and more complex over the past decades. Once was enough to supply a society with cheap and sufficient food products, wheras today much more is expected from the agricultural sector (Rohwer 2010). The expectations incorporate compliance with regulations to be entitled for EU subsidies (Morgan et al. 2012; Sørensen, Bochtis 2010), new and stricter guidelines for the use of agrochemicals (Villaverde et al. 2014), food safety (Magnuson et al. 2013) and animal welfare requirements and environmental concerns (Malcolm 2004; BMELV 2004). In fact, the farming business has shifted to a multifunctional service sector (Schöpe 2005).

The second reason why farm management became more and more difficult, lays within the farms themselves. In Germany the total number of farms has decreased since the 1970s whereas the cultivated area did not change substantially (© Statistisches Bundesamt 2012) . Consequently, the remaining farms have become larger to benefit from economies of scale (Nause 2003) but they also became more difficult to manage (Glauben et al. 2006).

The third reason is the introduction of modern technology has contributed to the challenge of sophisticated farm management. In this context modern technology incorporates in particular the usage of PCs coupled with the application of the corresponding software of the financial statements of farms, planning tasks for land cultivation husbandry etc. Additionally, many farmer introduced GPS added tractors and "smart" machinery, GIS-supported landscape modeling and other state of the art technology, making special knowledge indispensable (Linseisen et al. 2000; Zeddies 2001). All these technologies can be combined under the expression "Wired Farm" or "Precision Farming" (Sigrimis et al. 1999).

A major outcome of the three developments described is the generation of large data volumes. To handle and to benefit from these enormous data volumes farmers have to be capable of performing the following tasks:

1. Collection of Data
2. Processing of Data
3. Providing Data
4. Using Data

To deal with these four tasks, farmers have to introduce an integrated Information System (IS) sometimes also called Decision Support Systems (DSS).

Today, most IS or DSS have a special focus. "Dairy Comp 305" for instance, is an IS especially for the herd management of milking cows (Cerosaletti et al. 2004, 2004; Enevoldsen et al. 1995), whereas MicroLEIS (Meyer et al. 2013) and DSSAT (Sonam, Sawhney 2014) are developed as very useful tools for land cultivation. AFFOREST sDSS is especially developed for silviculturist (Orshoven et al. 2007) and StocKeeper for herd management of bulls (Grubb 2010).

2 Objectives and Methods

The objective of this paper is to give first a brief overview why modeling still has not had it is breakthrough in the farming sector. The paper is aiming on the development of a FMIS that depicts all production processes and their internal interconnections of a farm accurately. The first objective deals with the question, why FMISs' pervasion performance in today's farming sector is still poor. The second one aims on identifying the most successful FMIS approaches currently applied.

The development of the FMIS model is based on a system approach that observes the farm as an open system, with productional, technological, economic and social subsystems. Firstly, a system analysis of the farm has been conducted, aiming on the identification and analysis of all the material and information flows, production processes and their interconnections. This procedure is imperative to describe the farm's production systems accurately. The procedure incorporates the data collection by conducting visual inspections (fields, animal facilities, machinery etc.), interviews with the farmer and his laborer and a thorough analysis of the farm's financial data, including balance sheets and profit and loss statements, the operating plan including spraying and fertilizing dates and crop rotation scenarios. On the basis of the collected information a farm fact book has been completed, dealing with basic external and internal conditions.

Consequently the FMIS model has been designed, based on the system analysis and the individual information requirements of the farmer. The FMIS design comprised a listing of all production processes, focusing particularly on the internal exchange of goods. Lastly, the gained information was transferred into a marginal cost model. This approach does not take fix costs into account. Therefore, all fixed assets (plant and equipment) are considered immutable. In other words, the model does not consider future investment or disinvestment decisions and has therefore solely a short term character.

3 Results and Discussion

As mentioned earlier the reasons why farmers hesitate to apply modeling to their farm are various. In the last 20 years scholars brought up several explanations. Figure 1 facilitates the understanding of their argumentation.

Complexity is one of the major impediments for the application of modeling. And this complexity occurs very different ways. First, one has to acknowledge the complexity of the farms organization itself. Various, partially very different production processes (land cultivation, husbandry etc.) have to be tuned properly. Additionally, farmer deal with biological system which can never be fully controlled.

Market risk (change of prices), financial risk further increase the number of uncontrollable factors. These two sources of complexity, namely the farm and its environment lead to complex models. But complex models are expensive, difficult to understand and to use. These are unfavorable premises for an easy and swift

adaptation. The huge number of uncontrollable factors and their significant influence on the farm's profitability have another negative side effect.

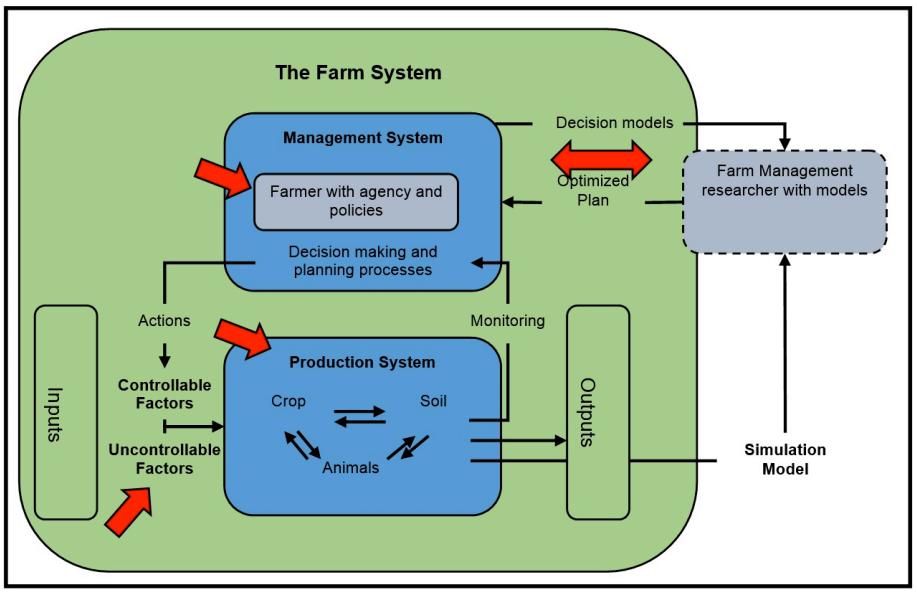

Fig. 1. The Farm System after (Sorensen & Kristensen, 1992)

When it comes to modeling of farms the first outcome of the farm analysis is a comprehensive "Farm Fact Book" which consists of the following elements: "Basic information", "Natural conditions", "Machinery", "Human resources", "Buildings", "Farm details" and "Infrastructure".

In a second step we analyzed general FMIS models. Most FMIS models in literature have quite simple structure. The structure of the general FMIS incorporates two technologies, namely plant production and livestock production. When all activities and their input respectively output factors are evaluated with prices, then an accurate calculation can be conducted. In terms of livestock production the "Herd Organization Structure" has to be considered additionally. From the calculations of the plant production the services and the livestock production one receives the coefficients necessary for the linear programming program (LP-Program). This program also considers market limitations (e.g. max. quantity salable) and production limitations (e.g. the max. available agricultural land).

The analyzed case study farm is a good example of a complex farm structure. The case study farm as displayed in Figure 2 has three major braches, namely "Plant Production", "Services" and "Livestock Production". The branch "Plant Production" has four subunits. The first subunit, called "Arable Farming" displays the three main crops, which the farmer cultivates. These crops follow the common regional scheme of crop rotation: winter wheat, winter barely, winter canola. Grain maize is only occasionally cultivated as a surrogate crop in the case that the three main crops can't be cultivated. "Feed Crops" incorporates grassland for the hay production and grain

maize, which is sold to food suppliers who meliorate and resell it as pig feed to the farmer. The pasture is exclusively used for the horses during the summer.

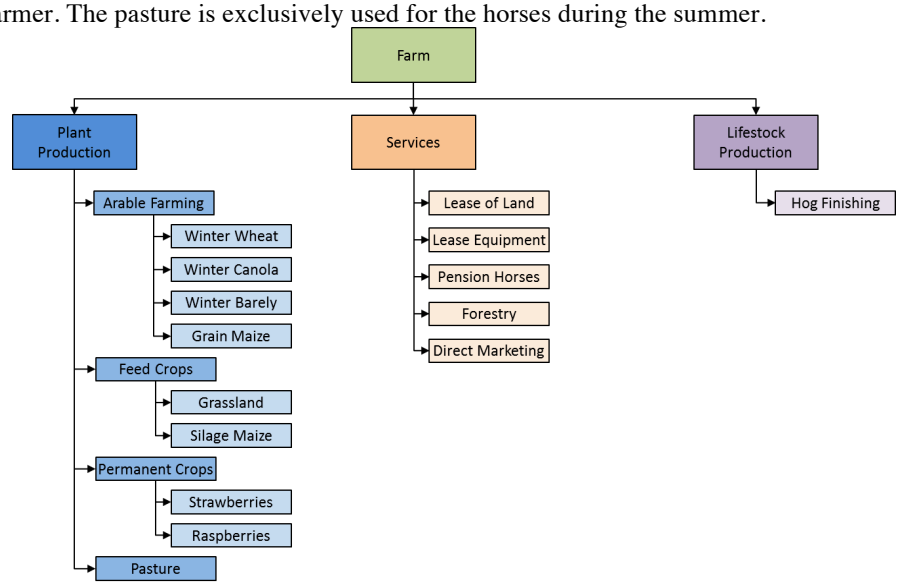

Fig. 2. The Farm Structure

The branch "Livestock Production" solitarily deals with "Hog Finishing". The 700 place of the pig stall are the biggest source of income of the case study farm, which is totally independent of the season (Figure 3).

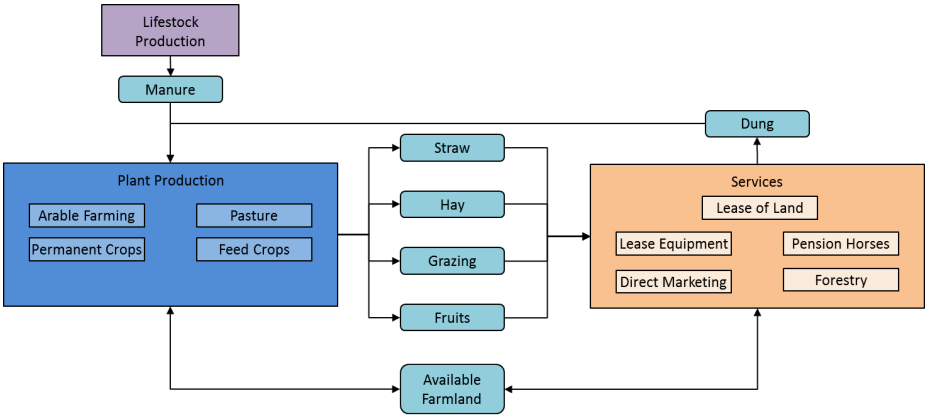

Fig. 3. Internal Material Flows of the Case Study Farm

4 Conclusion

The findings of this paper have pointed out that well balanced and carefully considered management decisions are more important for the surviving of farms. Reasons are the grown external and internal complexity of the farming business and its higher exposure to financial risks. It is likely that these factors will become even more significant in the future making a professional decision making support system indispensable. A sophisticated FMIS can be an important contribution to attain better management decisions. It has to allow farmers to easily access all information which are crucial for the farms profitability.

The minimum requirements for such a FMIS are:

1. Monitoring/Data collection
2. Planning/Scenario analysis
3. Controlling/Target-actual comparisons
4. Identification of optimization potentials /Profit maximization

However, one has to consider the enormous effort connected with a proper setup of a FMIS. Co-products, internal exchange of good or non-marketable products (e.g. crop-rotation) and a thorough cost accounting as a basis are just some factors, which have to be considered. Moreover, when it comes to optimizations (profit maximization), an allocation optimum for the entire farm is difficult to identify, since the scare resources differ from production process to productions process (arable land, feeding places, machine hours etc.). Nevertheless, the benefits of a FMIS are paying off for farmers on the long run, because a well-developed FMIS can support a decisions making process which is based on facts and not on gut instinct.

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Classification of Winter Rapeseed Cultivars and their Yield Characters with the Common Vector Approach

Nurdilek Gülmezoğlu[1], Zehra Aytaç[2] and M. Bilginer Gülmezoğlu[3]

[1]Department of Soil Science and Plant Nutrition, Faculty of Agriculture, Eskişehir Osmangazi University, 26480, Eskişehir, Turkey, e-mail: dgulmez@ogu.edu.tr
[2]Department of Field Crops, Faculty of Agriculture, Eskişehir Osmangazi University, 26480, Eskşehir, Turkey, e-mail: zehrak@ogu.edu.tr
[3]Department of Electrical and Electronics Engineering, Faculty of Engineering and Architecture, Eskişehir Osmangazi University, 26480, Eskişehir, Turkey, e-mail: bgulmez@ogu.edu.tr

Abstract In this study, five cultivars (Ceres, Zorro, Falcon, Express, and Samourai) of winter rapeseed were classified by using the common vector approach (CVA). For this purpose, seven yield characters (plant height, number of branches per plant, number of pods per plant, number of pods on main stem, number of seeds per pod, pod length and thousand seed weight) of each cultivar were used. The seven and six yield characters taken from five cultivars were classified by using CVA. 100% classification rate is guaranteed for the training set of both studies. For the test set, the classification of five cultivars has low performance, but the classification of seven and six yield characters gave satisfactory results**.** It is concluded that the CVA method was successful in the classification of different varieties belonging to any plant and/or of different characters belonging to any variety.

Keywords: Character classification, common vector approach, rapeseed classification.

1 Introduction

Rapeseed is an important oilseed crop in the agricultural systems of many arid and semiarid areas. Agronomic and quality advantages of new varieties have enlarged their production areas worldwide (Gül et al. 2007). Rapeseed in Turkey is mostly cultivated as a winter annual for oil production and rarely livestock feed. If planted in spring, they can be grown as summer crop but the seed yield would be decreased due to short growing season and lack of enough water at the end of growing season, thus, winter cropping is preferred. The canola cultivars are slow growing especially in winter and most of them will complete their life cycle in 210 to 270 days (Sharghi et al. 2011). There are wide variations among the cultivated canola cultivars with respect to seed and oil yields per unit area at different planting dates as well as irrigation regimes. The seed yield and maturity of canola is greatly influenced by fertility management, seeding rate and seeding date (Grant and Bailey, 1993).

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Computer-based algorithms have been extensively used in agriculture in order to classify various plants and their characters or samples. Classification of plant varieties with computer algorithms has been become popular in recent years. The common vectors representing the invariant features of the plants can be extracted by eliminating the differences in each class of plants (Gülmezoglu 1999). Then these common vectors are used for the classification of varieties and characters of plants. Different methods were used in order to derive features or parameters from plant varieties (Wang et al., 1999; Zayas et al., 1996; Utku and Köksel, 1998; Delwiche & Massie, 1996; Neuman and Bushuk, 1987; Shuaib et al., 2010). Some classifications were analyzed for characters of rapeseed. Ali et al. (2012) analyzed for near infrared spectroscopy and principal component grain of rapeseed. Jankulovska et al. (2014) presented the use of different multivariate approaches to classify rapeseed genotypes based on quantitative traits. Some of these parameters were plant height, number of primary branches per plant, number of pods per plant, pod length, number of seeds per pod, seed weight per pod, 1000 seed weight, seed weight per plant and oil content. This model has been applied in agricultural sciences to identify the effect of yield character differences (Gülmezoğlu and Gülmezoğlu 2015). However, there is no information on the use in plant breeding programs.

In this study, we considered five cultivars (Ceres, Zorro, Falcon, Express, and Samourai) of winter rapeseed. Initially, these cultivars were classified by using the common vector approach (CVA). Secondly**,** seven yield characters (plant height, number of branches per plant, number of pods per plant, number of pods on main stem, number of seeds per pod, pod length and thousand seed weight) and six yield characters excepting number of branches per plant were classified by using CVA.

2 Material and Method

This research was carried out over three years during 2005 at the Faculty of Agriculture of Eskisehir Osmangazi University, Eskisehir (39^{o} 48′ N; 30^{o} 31′ E; 789 m in elevation). The field experiments included five winter rapeseed cultivars (Ceres, Zorro, Falcon, Express, Synergy and Samourai). The experiment was planned in a Randomized Complete Block Design with four replications. The individual plots were 3 m long and consisted of five rows. The cultivars were sown on the first week of September, using a seed rate of 10 kg ha $^{-1}$ in 40 cm spaced lines on a well prepared seed bed. The experiment was fertilized respectively with 150 kg N ha $^{-1}$ as ammonium nitrate: 33-0-0 and 50 kg P_2O_5 ha -1 as di-ammonium phosphate: 18-46-0. The plants were irrigated once during emergence and thinned at the rosette stage. The weeds were controlled by hand weeding.

Each cultivar was represented with seven yield characters which are plant height, number of branches per plant, number of pods per plant, number of pods on main stem, number of seeds per pod, pod length and thousand seed weight. Each character includes 20 plant samples which were taken from field study conducted during growing year.

As in all classification methods, CVA has training and testing stages. In the training stage, a common vector which represents common or invariant properties of

each class is calculated and an in difference subspace for each class is constructed. Let the vectors $\mathrm{a}_1^c, \mathrm{a}_2^c, \ldots, \mathrm{a}_m^c \in \mathrm{R}^n$ be the feature vectors for a variety-class C in the training set where $m \leq n$. Then each of these feature vectors which are assumed to be linearly independent can be written as

$$\mathbf{a}_i^c = \mathbf{a}_{i,dif}^c + \mathbf{a}_{com}^c + \varepsilon_i^c \qquad \text{for} \quad i=1,2,\ldots,m \qquad (1)$$

where the vector $\mathbf{a}_{i,dif}^c$ indicates the differences resulting from climatic effects and alien-pollination, and the vector $\mathbf{a}_{com}^c$ is the common vector of the variety or character class C, and ε_i^c represents the error vector (Gülmezoğlu et al. 2001). The common vector can be obtained from the subspace method. Let us define the covariance matrix of the feature vectors belonging to a variety or character class as

$$\mathbf{\Phi} = \sum_{i=1}^{m} (\mathbf{a}_i^c - \mathbf{a}_{ave}^c)(\mathbf{a}_i^c - \mathbf{a}_{ave}^c)^T \qquad (2)$$

where $\mathbf{a}_{ave}^c$ is the average feature vector of C^{th} class whose covariance matrix is to be calculated and *T* indicates the transpose of a matrix.

The eigenvalues of the covariance matrix $\mathbf{\Phi}$ are non-negative and they can be written in decreasing order: $\lambda_1 \geq \lambda_2 \geq \mathrm{K} \geq \lambda_n$. Let $\mathrm{u}_1^c, \mathrm{u}_2^c, \ldots, \mathrm{u}_n^c$ be the orthonormal eigenvectors corresponding to these eigenvalues. The first (*m*-1) eigenvectors of the covariance matrix corresponding to the nonzero eigenvalues form an orthonormal basis for the difference subspace B (Gülmezoğlu et al. 2001). The orthogonal complement, $\mathrm{B}^{\perp}$, is spanned by all the eigenvectors corresponding to the zero eigenvalues. This subspace is called the indifference subspace and has a dimension of (*n*-*m*+1). The direct sum of two subspaces B and $\mathrm{B}^{\perp}$ is the whole space, and the intersection of them is the null space. The common vector can be shown as the linear combination of the eigenvectors corresponding to the zero eigenvalues of $\mathbf{\Phi}$ (Gülmezoğlu et al. 2001), that is,

$$\mathbf{a}_{com}^c = \left\langle \mathbf{a}_i^c, \mathbf{u}_m^c \right\rangle \mathbf{u}_m^c + \mathrm{L} + \left\langle \mathbf{a}_i^c, \mathbf{u}_n^c \right\rangle \mathbf{u}_n^c \;\forall\; i=1,2,\ldots,m \qquad (3)$$

From here, the common vector acom is the projection of any feature vector onto the indifference subspace $\mathrm{B}^{\perp}$. The common vector represents the common properties or invariant features of the variety or character class C. The common vector is independent from index *i.* Therefore, the common vector is unique for each class and all the error vectors ε_i^c would be zero.

During the classification stage, the following decision criterion is used:

$$distance = \underset{1 \leq C \leq S}{argmin} \left\| \sum_{j=m}^{n} \left\{ \left[\left(\mathbf{a}_x - \mathbf{a}_i^c \right)^T \mathbf{u}_j^c \right] \mathbf{u}_j^c \right\} \right\|^2 \qquad (4)$$

where $\mathbf{a_x}$ is an unknown or test vector and *S* indicates the total number of classes. If the distance is minimum for any class C, the feature vector $\mathbf{a_x}$ is assigned to class C.

Classification algorithm given above can be summarized as follows:

Step 1: Construct feature vectors by using samples taken for each character belonging to any cultivar. Be sure that number of samples in each feature vector (or dimension of each feature vector) is greater than number of feature vectors (or characters) for each cultivar.

Step 2: Find the covariance matrix (Eq. (2)) for each cultivar by using feature vectors belonging to that cultivar.

Step 3: Find the eigenvalues λ_i and corresponding eigenvectors u_i for each covariance matrix.

Step 4: Find the common vector (Eq. (3)) for each cultivar by using the $(n-m+1)$ eigenvectors corresponding to zero eigenvalues.

Step 5: When an unknown feature vector $\mathbf{a_x}$ is given, classify this vector by using Eq. (4).

3 Results

In the first study, each of five cultivars forms one class in the CVA method. Seven characters each of which includes 20 samples for each cultivar or class form seven feature vectors of that class. Therefore, there are five classes and each class has seven feature vectors. When the feature vectors (characters) used in the training stage were tested, all classes (cultivars) were correctly classified, i.e., 100% correct recognition rate was obtained. When the "leave-one-out" strategy was used in the testing stage, that is, when six feature characters were used in the training stage and remaining one character was tested, 25.7% correct recognition rate was obtained as average of "leave-one-out" steps. The results obtained from this study are given in Table 1. The average score obtained in the test set is very low because samples included in the characters representing different cultivars are very close to each other.

In the second study, the characters were classified by using CVA. First of all, seven characters were considered and each of seven characters forms one class in the CVA method. Twenty samples taken from each cultivar for any character form one feature vector of that character. Therefore, there are seven classes and each class has five feature vectors. When the feature vectors, each of them includes 20 samples, used in the training stage were tested, all classes (characters) were correctly classified, i.e., 100% correct recognition rate was obtained. When the "leave-one-out" strategy was used in the testing stage, that is, when six feature characters were used in the training stage and remaining one character was tested, 77.1% correct recognition rate was obtained as average of "leave-one-out" steps. The results obtained for this study are given in Table 2.

Table 1. Correct recognition rates of five cultivars as percentage.

Varieties	Training set	Test set
Samourai	100	14.3
Zorro	100	42.9
Falcon	100	28.6
Ceres	100	0
Express	100	42.86
Average	100	25.7

Table 2. Correct recognition rates of seven yield characters as percentage.

Yield Characters	Training Set	Test Set
Plant Height	100	100
Number of Branches per Plant	100	0
Number of Pods per Plant	100	40
Number of Pods on Main Stem	100	100
Number of Seeds per Pod	100	100
Pod Length	100	100
Thousand Seed Weight	100	100
Average	100	77.1

Secondly, six characters excepting number of branches per plant were classified. All characters were correctly classified (100% correct recognition rate was obtained) in the training set and 90% recognition rate was obtained for the test set. These scores are remarkable because samples taken from cultivars for each character are close to each other and well represent that character. These results are given in Table 3.

Table 3. Correct recognition rates of six characters as percentage

Yield Characters	Training Set	Test Set
Plant Height	100	100
Number of Pods per Plant	100	40
Number of Pods on Main Stem	100	100
Number of Seeds per Pod	100	100
Pod Length	100	100
Thousand Seed Weight	100	100
Average	100	90

4 Discussion

It is known that varieties of different plants have been successfully classified by using various computer-based algorithms. Especially, classification of wheat varieties with computer algorithms has been become popular in recent years (Zayas et al. 1996, Utku and Köksel 1998, Neuman and Bushuk 1987, Gülmezoğlu and Gülmezoğlu 2015). Therefore, in this study, first of all, five rapeseed varieties were classified by using CVA method. In spite of 100% correct recognition rate in the training set, very low recognition rate (25.7%) was obtained in the test set. The reason is that samples included in the characters representing different varieties are very close to each other. Thus, common properties or invariant features of each variety cannot be correctly extracted and indifference subspace cannot be constructed efficiently.

Additionally, characters were classified by using CVA method. Initially, seven characters are applied to the classification process and 100% and 77.1% recognition rates were obtained for the training and test sets respectively. The reason of low score for the test set is that the samples belonging to number of branches per plant character are similar to samples belonging to other characters. When the number of branches per plant character is discarded, that is, when the remaining six characters are classified, 90% recognition rate is obtained for the test set.

5 Conclusion

It is concluded that the CVA method was very successful in the classification of different varieties belonging to any plant and/or of different characters belonging to any variety. Such classifications can be very helpful in assignment of unknown varieties or unknown characters to identify plant. When more specific characters are extracted for each variety of plants, good performance can be achieved from the classification process.

As a future work, number of varieties for any plant and the number of characters will be increased. Satisfactory results are also expected from this work.

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The Role of Olive Trees Distribution and Fruit Bearing in Olive Fruit Fly Infestation

Romanos Kalamatianos[1], Markos Avlonitis[2]

[1]Department of Informatics, Ionian University, Greece, e-mail: c14kala@ionio.gr
[2]Department of Informatics, Ionian University, Greece, e-mail: avlon@ionio.gr

Abstract. The role of fruit bearing percentage in olive fruit fly infestation is investigated through a simulation model where the spatial law of dispersion distances were modeled via an appropriate exponential law. The dispersal of olive fruit flies was simulated for two distinct cases, an olive grove with no olive fruits and an olive grove with 100% olive fruit bearing. Results showed that when no olive fruits were present the olive fruit flies scatter in all directions away of the starting point, while when the olive grove is full of olive fruits the olive fruit flies form a cluster around the starting position with almost zero mean travel distance.

Keywords: olive fruit fly, simulation model, olive fruit bearing, dispersion

1 Introduction

The olive fruit fly is an ancient pest that nowadays infests many olive groves worldwide and is the main cause of tremendous damage for both table olive and oil production, when no control measures are applied (Rice 2000). The olive fruit fly goes through four stages during its development, namely, egg, larva, pupal and adult. The number of generations that can appear per year depends upon local conditions, for example in Southern California six or seven generations could appear within a year (Rice et al. 2003).

Voulgaris et al. (2013) proposed a simulation model that estimates the population evolution of the olive fruit fly. The said model given real trap data as input, as well as climate data, could predict olive fruit fly outbreaks. Thus, the proposed model could be used as real-time alert system of olive fruit fly outbreaks. In their experiments, they demonstrated, that having knowledge of upcoming outbreaks could lead to estimating the appropriate time to apply population control methods.

Kalamatianos et al. (2015) build upon and upgraded the aforementioned model by inserting randomness in the development process of the immature stages of the olive fruit fly, as well as making the spatial dispersion of the olive fruit fly temperature dependent. In their experiments, it was shown how the number of starting areas in conjunction with different temperature sets and drifting distances affects the level of olive grove infestation.

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In this paper, the simulation model is modified further by making the dispersion distance of the olive fruit fly dependent on the percentage of olive fruit present inside the olive grove. This modification was based on the findings of a study done by Fletcher and Kapatos (1981) in Corfu, Greece. Through their experiments it was shown that the olive fruit fly when released in an area with no olive fruit it would travel over 400m on average in the first week. Field data from this experiment are shown in Fig. 1. On the other hand, when released in an area with 30% fruit bearing the olive fruit fly would travel on average 180m in the first week. Furthermore the time resolution of the simulations was changed from a time step of one day to one hour. Our aim is to show how the olive grove infestation is affected by the fruit bearing percentage.

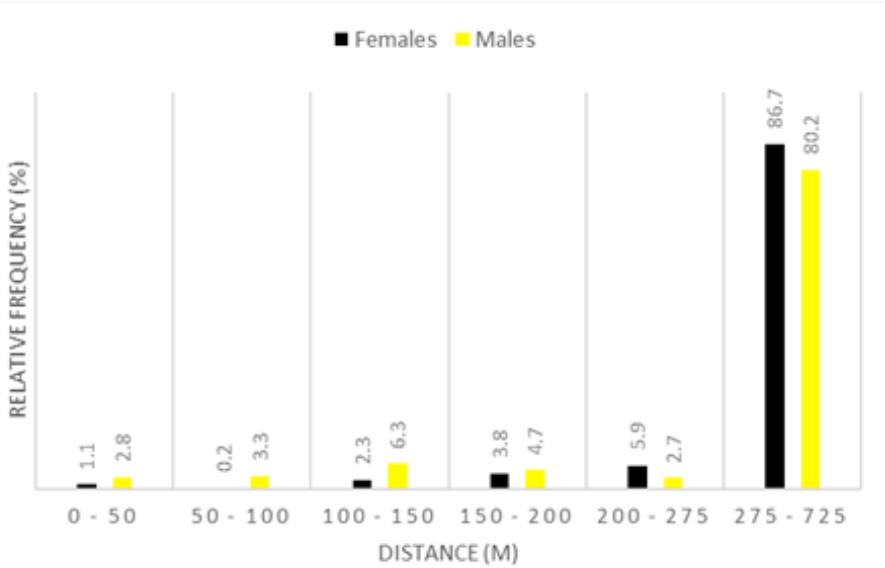

Fig. 1. Relative frequencies of olive fruit flies in an olive grove with no olive fruit bearing between 4 – 10 days after release. (Fletcher and Kapatos, 1981)

2 Methodology

2.1 Simulation Model

Initially, the grid on which the simulation will take place was constructed. The simulation model parses an image file which contains information about the field.

More specifically, each pixels color indicates the presence of olive trees (black color) or not (white color). Each cell in the constructed grid corresponded to a 10m x 10m area. Thus the minimum distance an olive fruit fly could travel inside the grid was 10m in either direction. Finally, an overlaying grid of trap cells, each corresponding to a 100m x 100m area, is constructed which are used to monitor the population size.

Each olive fruit fly passes through five transformation stages egg, larval (all instars are grouped into one stage), pupal, sexually immature adult and perfect adult. Olive fruit flies that are in one of the first three of the aforementioned stages are immobile throughout the simulation and can start drifting once they reach the fourth transformation stage.

In the initial code (Kalamatianos et al., 2015), the time resolution of the simulation was one day (one simulation step corresponds to one day), therefore the degree-day model was used for the development of the immobile population. In each simulation step, olive fruit flies that belong in the immobile population compute the degree-day units accumulated based on the temperature that was present. The following function was used to compute the accumulated degree-day units:

$$DD(t_i) = (t_i - T_L) * (1 - (1 / (1 + \exp(-10 * (t_i - T_U))))) . \quad (\mathbf{1})$$

Where t_i is the temperature present in the i-th simulation step, T_L and T_U are the lower and upper developmental thresholds, respectively, of each insect.

All olive fruit flies that are in the perfect adult stage can reproduce and can lay up to three eggs in their lifespan and a maximum of one egg per simulation step. The total number of eggs laid by an adult olive fruit fly was selected to account for mortality in all life stages of the olive fruit fly (Kapatos, n.d.).

Drifting of the mobile population of the olive fruit fly inside the field is achieved by using the random walk model. Each insect in each simulation step computes a random distance to travel and has an equal chance to move to any direction horizontally and vertically. Although drifting inside the field is done randomly, it is also temperature dependent and is currently affected only by high temperatures. Therefore the following function is used to calculate the final distance the olive fruit fly will travel (Kalamatianos et al., 2015):

$$D(d,t_i) = d * (1 - (1 / (1 + \exp(-10 * (t_i - T_U))))) . \quad (\mathbf{2})$$

Where t_i is the temperature present in the i-th simulation step, T_U is the upper movement threshold and d the randomly computed distance to travel of each insect. The upper movement threshold was set to 35 ^oC, beyond this temperature the olive flies are motionless (Avidov, 1954, cited by Johnson et al. 2011).

2.2 Modifications

For the purposes of this paper the following modifications were made to the existing simulation model.

The first modification was the change of the time resolution to one hour, thus one simulation step corresponded to one hour. This modification caused the use of the degree-hour model in place of the degree-day model, which is more accurate and doesn't underestimate heat summation (Gu et al., 2014). The following function was used to compute the accumulated degree-hour units, based upon (1).

$$DH(t_i) = DD(t_i) / 24 \ . \quad (\mathbf{3})$$

Changing to an hourly based simulation, affected reproduction and drifting of the olive fruit fly, as it was possible only in hours that corresponded to the daytime of a day. Finally, as a result of the time resolution change, the area that each cell grid represented was changed to a 1m x 1m area.

The second modification was to make the travelling distance (d) in (2), of the olive fruit fly, dependent from the percentage of olive fruit present in the occupying cell. To achieve this we based our changes on the findings of Fletcher & Kapatos (1981), who concluded that when there is no olive fruit present the olive fruit flies travel an average distance of 441m (based upon their published data) in a week and when olive fruit bearing is 30% the average distance traveled, decreases to 180m in a week. Fig. 2, Curve (a), displays an exponential fit on those two points. However, one would suspect that when olive fruit bearing is 100% then there is no reasonable reason for the olive fruit fly to have a preferred moving direction. As a result we expect that the flies will perform a pure random walk stochastic procedure with almost zero mean distance from the starting point. Therefore, based on the previous mentioned assumption, we applied an exponential fit on the following points, for 0% of olive fruit presence olive fruit fly travels an average distance of approximately 450m a week and for 100% olive fruit presence the average distance decreases to approximately zero meters a week (Fig. 2, Curve (b)). It is noted that since the average distance between olive trees is about 5m to 10m and a non-uniformity of fruit bearing between neighboring trees may be emerged we may observe an average deviation of 5m to 10m of cluster center from the initial position.

Thus, the following function was used to calculate the distance to disperse based on fruit percentage:

$$d(x, y) = (451.8 * \exp(-0.04098 * fp(x,y))) / wh \ . \quad \mathbf{(4)}$$

Where fp(x,y) is the olive fruit percentage on (x,y) coordinates of the grid and wh the total daytime hours in the current week. It is important to note that the minimum distance an olive fruit fly can travel inside the simulated grid was 1m.

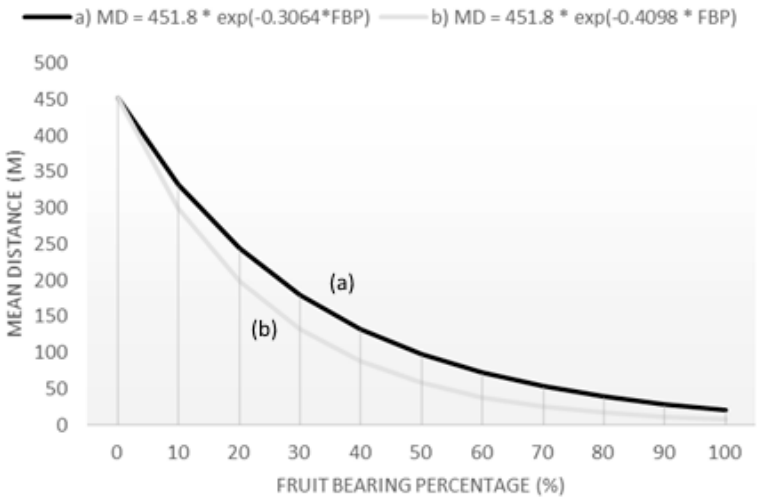

Fig. 2. Exponential laws for the mean traveled distance of olive fruit flies. Curve (a) corresponds to the field measurements (Fletcher and Kapatos, 1981), curve (b) exponential law reproducing no preferred direction for 100% fruit bearing.

It is noted that a discrepancy between the field data of Fletcher and Kapatos (1981) and our estimation for the value of 180m mean dispersion distance is emerged. This could be explained by the difficulty to accurately measure olive fruit bearing. It is easy to estimate olive grove of 0% or 100% fruit bearing but this is not the case for bearing values between those limited values.

Furthermore we modified the random walker model used by the olive fruit flies to disperse inside the field in the following way. Each olive fruit fly starts with a 50% chance to move left or right and up or down. Based on the olive fruit percentage of the cell it moves, the chance to move in the same direction increases, which subsequently means that the chance to move on the opposite direction decreases. If the olive fruit fly moves to a cell with different fruit percentage than the previous one then the chance to move in either direction is reset to 50% and the process is repeated.

2.3 Simulation scenarios

For the following simulation scenarios the immobile population is not taken into consideration since only the dispersion of adult olive fruit flies for a limited time period of one week was considered.

Two simulation scenarios were conducted. For both scenarios dispersal was done inside a 1500m x 1500m area of olive grove. The simulation time was 168 steps which corresponded to one week. 10000 adult olive fruit flies were placed in the center of the field and started dispersing once the simulation started. Hourly temperatures used for the simulation period were from the year 2014 (obtained from

Meteo.gr (2015)). The daytime period for all the days of the simulation period was set to 14 hours. For the first scenario it was assumed that no olive fruit was present inside the olive grove, where the simulation took place. On the other hand for the second scenario it was assumed that the fruit percentage was 100%.

3 Results

Fig. 3 displays snapshots of the dispersal of the olive fruit flies inside the field, for the first simulation scenario, by the end of 2, 4 and 7 days after the simulation started. On the end of the second day, the olive fruit flies are still forming a cluster around the starting position.

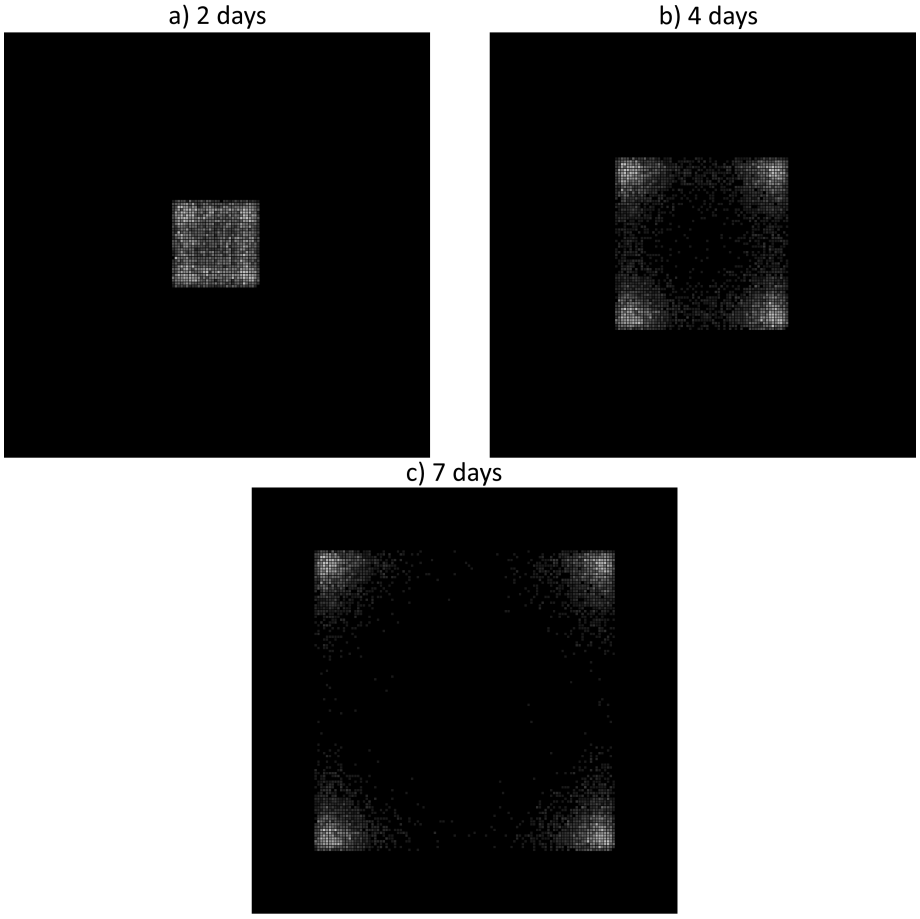

Fig. 3. Dispersal of olive fruit flies for second simulation scenario (a) 2 days, (b) 4 days and (c) 7 days after simulation started. White colored cells are occupied cells, black colored cells are unoccupied cells.

By the end of the fourth day the previous cluster has expanded on all directions and by the end of the seventh day four main clusters can be observed heading for the corners of the field with a few areas in between being infested while no presence of olive fruit fly can be seen around the starting position.

Fig. 4 displays the distribution of the final position of the olive fruit flies in relation to their starting position, for the first simulation scenario. Olive fruit flies near the starting position were very few for both axis, while when moving away from the starting position in either direction the frequency of olive fruit flies starts to increase. It can be seen that the final olive fruit flies distribution in time and space coincide with the field findings in Fletcher and Kapatos (1981) as depicted in Fig. 1.

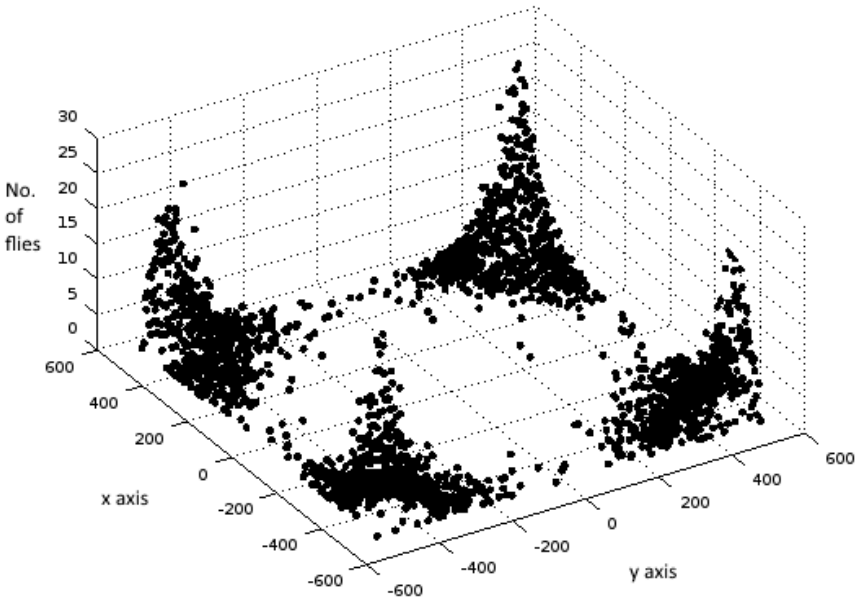

Fig. 4. Distribution of final positions in relation to the starting position of the olive fruit flies.

For the second simulation scenario, Fig. 5 displays snapshots of the dispersal of the olive fruit flies inside the field by the end of 2, 4 and 7 days after the simulation started. On the end of the second day, the olive fruit flies are forming a cluster around the starting position. By the end of the fourth day the previous cluster has expanded by a few meters on all directions while a great number of olive fruit flies is still around the starting position. Finally, by the end of the seventh day the cluster around the starting position still holds although it has expanded further since the fourth day, again by a few meters.

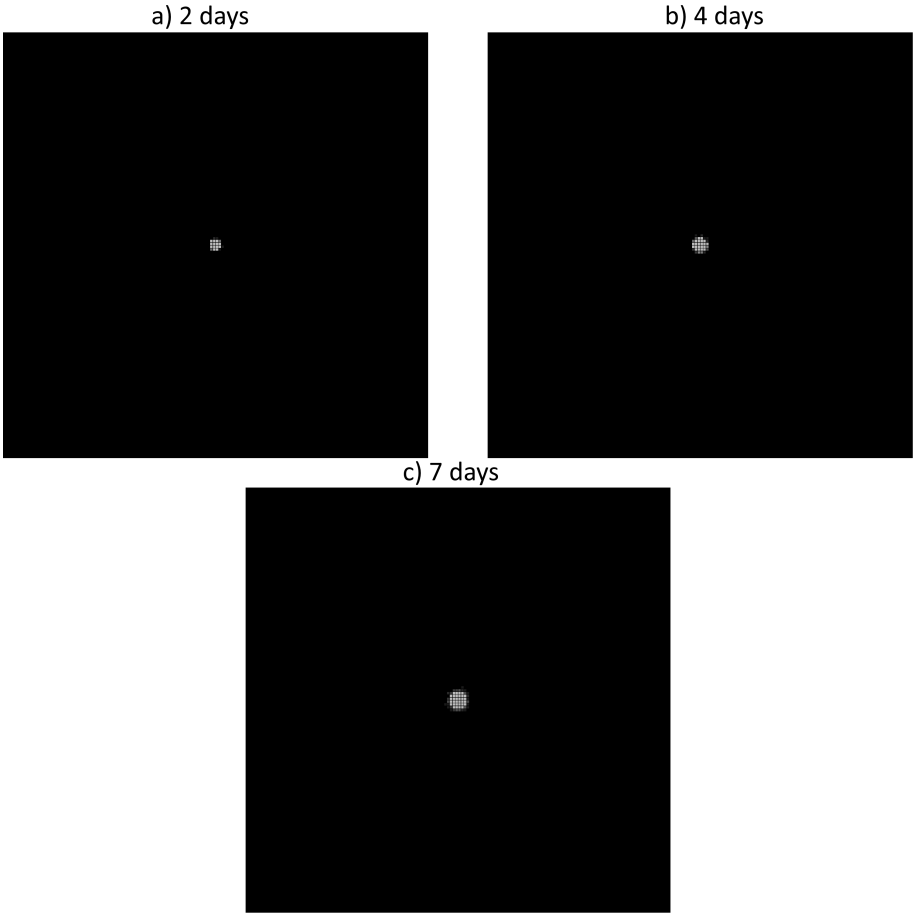

Fig. 5. Dispersal of olive fruit flies for the second simulation scenario (a) 2 days, (b) 4 days and (c) 7 days after simulation started. White colored cells are occupied cells, black colored cells are unoccupied cells

Fig. 6 displays the distribution, for both axis, of the final position of the olive fruit flies in relation to their starting position, for the second simulation scenario. As one can see the distribution of the flies follows a normal distribution.

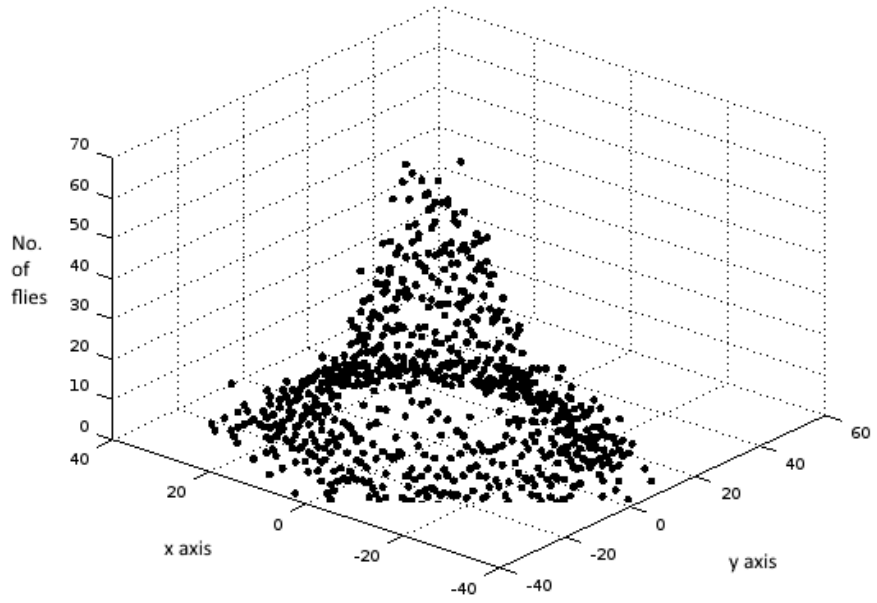

Fig. 6. Distribution of final positions in relation to the starting position of the olive fruit flies.

4 Discussion

Our simulation model was modified in order for the dispersal distance of the olive fruit fly to be depended by the fruit percentage inside the olive grove it resides. Additionally, the time resolution of the simulation model was changed to one hour, for more accurate results.

When the olive fruit flies were placed in an olive grove without new olive fruits they started scattering in all directions away of the starting position and by the end of the week none was near the starting position. On the other hand, when placed in an olive grove with 100% olive fruit after a week all olive fruit flies had dispersed around the starting position forming a cluster around it.

Finally, although Fletcher and Kapatos (1981) showed that for a fruit percentage of 30% olive fruit flies traveled an average of 180m in a week, according to the function we used to calculate the mean distance that an olive fruit fly would travel based on the fruit percentage, this distance corresponds approximately to 25% olive fruit bearing.

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The Use of Unmanned Aerial Systems (UAS) in Agriculture

Ioanna Simelli[1], Apostolos Tsagaris[2]

[1]MIS, University of Macedonia, Thessaloniki, Greece, e-mail: ioanna.simeli@gmail.com
[2]Department of Automation, Alexander Technological Educational Institute of Thessaloniki, Greece, e-mail: tsagaris@autom.teithe.gr

Abstract. Unmanned aerial vehicles (UAVs) represent technological developments used for precision agriculture. They provide high-resolution images taken from crops and when specific indices are applied, useful outputs for farm management decision-making are produced. The current paper provides a literature review on the use of UAVs in agriculture and specific applications are presented.

Keywords: Precision agriculture, UAS, unmanned aerial vehicles.

1 Introduction

Unmanned Aerial Systems (UAS) are aerial vehicles, which come in wide varieties, shapes and sizes and can be remotely controlled or can fly autonomously through software-controlled flight plans in their embedded systems working on the basis of GPS.

A UAS is made up of light composite materials to reduce weight and increase position-changing capability. Due to the usage of composite material strength they may fly at extremely high altitudes. They may have embedded various navigation systems or recording devices such as RGB cameras, infrared cameras, etc.

Some of the advances of the use of UAS are that they are lightweight and easy to transport, they capture high resolution and low cost images, they can fly at variety of altitudes depending on data collection needs, they can travel areas which are not accessible via car, boat, etc., they are extensively used in rescue operations, helping in delivering medicines and food, providing the live status of affected area, communicating in crisis, etc, quick availability of raw data.

2 Unmanned Aerial Systems

In recent decades, there have been significant efforts around increasing flight duration, the payload, and tolerance to various weather conditions, resulting in different UAV configurations with different sizes, duration of autonomy and

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competencies. A key criterion currently used to distinguish among aircrafts is the size and flight duration:

- Large autonomy, high altitude (HALE) UAV, such as for example, Northrop- Grumman Ryan 's Global Hawks (65.000 feet altitude, flight time 35 hours, payload 1,900 lbs).
- Medium Altitude Long Endurance (MALE) UAV, such as the General Atomics Predator (27.000 feet high, 30/40 hour flight, and beneficial load 450 lbs).
- Regular use UAVs as Hunter, Shadow 200, and Pioneer (15.000 feet high, Flight time is 5-6 hours, and 25 kg payload) and
- Small and portable UAVs from a man as the Pointer / Ranen (AeroVironment), Janelin (BAL) or Black Pack Mini (Mission Technologies).

3 Software and Hardware Technologies

The technologies developed for the UAV are specific in the sense that in order to compensate for the absence of the pilot and thus enable the flight of unmanned vehicles and their autonomous behavior, they are mainly based on the technologies of sensors and microcontrollers, of communication systems of Ground Control Stations and of UAS intelligence.

A very important issue in UAS is the automation system, which is used to control the machine. This system is separated into two parts. From the one side are the Control systems for the machine and in most cases they can be autopilot systems, which are used to control flights with several characteristics. Such systems contain GPS waypoint navigation with altitude and airspeed, fully integrated multi-axis gyroscopes and accelometers, GPS systems, pressure indicators and meters, pressure airspeed sensors, etc. All these sensors are mounted on hardware circuit boards. They have completely independent operation including autonomous take off and landing and Fail-safe commands programmed into the fly control system to address loss of altitude, loss of GPS connection, or loss of modem communication. The autopilot recognizes problems and initiates the land command, so that the UAS immediately flies back to the start point. The UAS can also be controlled manually with a lot of controlling systems through wireless communication.

On the other side are the control systems for the communication with the computer. The UAS have Ground Control Software, which provides the interface between the UAS and computer. This software enables programming of flight patterns and their pre-flight simulation, selection of flying files and transfer to other systems, tracking the flight path and monitoring the conditions during the flight with a computer-UAS online flight communication system. Finally a log file is available, with all the flight information, also available once the flight is completed.

Christophersen et al (2004) provide a small guidance, navigation, and control system based on FPGA (Field Programmable Gate Array) and DSP (Digital Signal Processor) technology to satisfy the requirements for more advanced vehicle behavior in a small package. Including those two processors into the system enables

custom vehicle interfacing and fast sequential processing of high-level control algorithms (Christophersen, H., et al.,, 2004). Primicerio et al. (2012) provide a UAV platform ‘‘VIPtero’’ which is an open-source project that is available with pre-assembled flight and brushless control boards, the main board responsible for the actual flight of the mikrokopter is built around an ATmega1284P microcontroller (Atmel Corporation, San Jose, CA, USA) and communicates to the six brushless controllers via a bi-directional two-wire serial bus. An additional navigation control board (NaviCTRL) equipped with an ARM9 microcontroller (Atmel Corporation, San Jose, CA, USA) and MicroSD card socket for waypoint navigation data storage is also present (Primicerio, J., et al., 2012). Pankaj Maurya (2015) uses a single board computer system development on Soekris net4521. It is based on a 133 Mhz 486 class processor. It uses a Compact Flash module for program and data storage. The Soekris net4521 a special electronic circuit controlled via linux platform. The data acquisition and filtering is done on an FPGA. The sensor data is digitized using an Analog to Digital converter card and then fed to the FPGA. The FPGA runs Kalman filtering on the received data. It provides the filtered values of the physical quantities – Velocity, Angle, angular velocity and the navigation quantities in the three axis (Maurya, 2015)

In many cases the construction of the UAS is integrated with Wireless Sensor Networks (WSN). The information retrieved by the WSN allows the UAS to optimize their use. For example to confine its spraying of chemicals to strictly designated areas. Since there are sudden and frequent changes in environmental conditions the control loop must be able to react as quickly as possible. The integration with WSN can help in that direction (Costa, F.G., et al., 2012).

5 Use of UAS in Agriculture

Agriculture couldn't be left out of the technological advances taking place worldwide in any scientific field. Furthermore, the need to secure food and water supplies for a global population that grows rapidly is a challenge to be addressed using information technology. Unmanned aerial vehicles (UAVs) represent these technological developments used for precision agriculture. They were initially used for chemical spraying while they were the solution to visibility problems due to cloudy weather or inaccessibility to a field of tall crops, like maize (Sugiura, Noguchi, & Ishii, 2005). They also have the strong advantage compared to satellite and airborne sensors of high image resolution (Jannoura, R., et al., 2015)

The production's increase, the improvement of the efficiency, the enhancement of profitability, the reduction of environmental impacts and the availability of quantifiable data from large farms are some of the benefits that precision agriculture using UAVs provides (Herwitz, et al., 2004, Xiang & Tian, 2011).

Questions, however, have risen regarding the usefulness of UAVs in agriculture. Questions regarding their effectiveness as far as the pictures taken are concerned, the inability of UAVs to fly in diverse weather conditions like rain that affects the quality of images or high wind, or finally the price of data elaboration.

It is currently financially viable for a farm manager to purchase a drone, when in 2005 it cost as much as an 120kW tractor (Sugiura, Noguchi, & Ishii, 2005). However, the purchase price is the least of the problems since the cost of image processing software to produce maps is far bigger. As the cost of purchasing and utilizing UAVs within the agriculture industry falls, interest in the sector is rapidly increasing.

5.1 Indices used in UAVs in agriculture research

Vegetation indices in remote sensing of crop weed plants is very common. Some indices use only the red, green and blue spectral bands (Meyer & Neto, 2008). The most common indices used are:

Green - Red Ratio Vegetation Index (GRVI) or Normalised Green - Red Difference Index (NGRDI): Reflectance in the green and red parts of the spectrum

Leaf Area Index (LAI): It characterizes plant canopies. One-sided green leaf area per unit gound surface area (LAI = leaf area / ground area, m2 / m2)

Normalised Difference Vegetation Index (NDVI): Ratio of the reflectance in the near-infrared and red portions of the electromagnetic spectrum NDI = G – R / G + R

Visible Vegetation Index (VVI) provides a measure of the amount of vegetation or greenness of an image using only information from the visible spectrum. The VVI is given by

$$\mathrm{VVI} = \left[\left(1 - \left|\frac{R - R_o}{R + R_o}\right|\right)\left(1 - \left|\frac{G - G_o}{G + G_o}\right|\right)\left(1 - \left|\frac{B - B_o}{B + B_o}\right|\right)\right]^{1/w}$$

where R, G, and B are the red, green, and blue components of the image, respectively, RGBo is vector of the reference green color, and w is a weight exponent to adjust the sensitivity of the scale.

Excess Green Index (ExG): Provides a near - binary intensity image outlining a plant region of interest (ExG = 2g – r– b)

5.2 Case studies

Coffee plantations were traditionally small (<50ha) and hand picking was the standard harvesting procedure. However, the plantations grew enormously, exceeding 200ha, and mechanical harvesting is currently used. Herwitz et al., used in 2004 the NASA's Pathfinder - Plus UAV as an image collection platform, with multispectral and hyperspectral digital imagers over land areas and coastal zone waters, for the Kauai Coffee Company, the largest coffee plantation in the US (approx. 1400ha).

Authors used the data gathered to spot differences in overall ground cover within fields. The acquired data revealed a positive relationship between brightness of the coffee tree canopy and the harvested yield of ripe coffee cherries.

In 2005, Sugiura et al, used an unmanned helicopter, flying over a sugar beet field

and a corn field, where they adopted a real-time kinematic global positioning system, an inertial sensor (INS) and a geomagnetic direction sensor (GDS) to acquire the leaf area index (LAI), an important value when estimating the crop growth. To evaluate the crop status using LAI, the accurate segmentation of crop and soil area is needed.

An autonomous UAV-based agricultural remote sensing system was used to monitor turf grass glyphosate application (Xiang & Tian, 2011)

Detection of the vegetation in herbaceous crops is the initial important stage when precision agriculture is applied. Thus high resolution images (mm or very few cm) is highly required. UAVs is the perfect tool for such a mission (Torres-Sánchez, J., López-Granados, F., & Peña, J.M., 2015).

Torres-Sanchez et al. in 2015 used two cameras (a conventional visible camera and a multispectral camera) on a UAV. Then they used the software eCognition Developer 8.9 which offers various options related to Object Based Image Analysis (OBIA) based on the Otsu's method to detect vegetation in fields of three different herbaceous crops (maize, sunflower and wheat). They initially used the multiresolution segmentation algorithm (MRSA). The two vegetation indices: Excess Green (ExG) index and Normalized Difference Vegetation Index (NDVI) were used. The plants were in their early growth stages that corresponds to the principal stage 1 (leaf development) of the ‘‘Biologische Bundesanstalt, Bundessortenamt und CHemische Industrie’’ (BBCH) extended scale. Since there were different spaces for crop separation (17 cm, 70 cm and 75 cm for wheat, sunflower and maize, respectively) whereas the plant morphology also varied (wheat and maize are monocotyledonous plants, and sunflower is a dicot), the images were very different among them, forming a complete image set to test the algorithm.

NDVI was also calculated after the application of herbicide on two plots using an UAV in 2007 (Fig. 1)

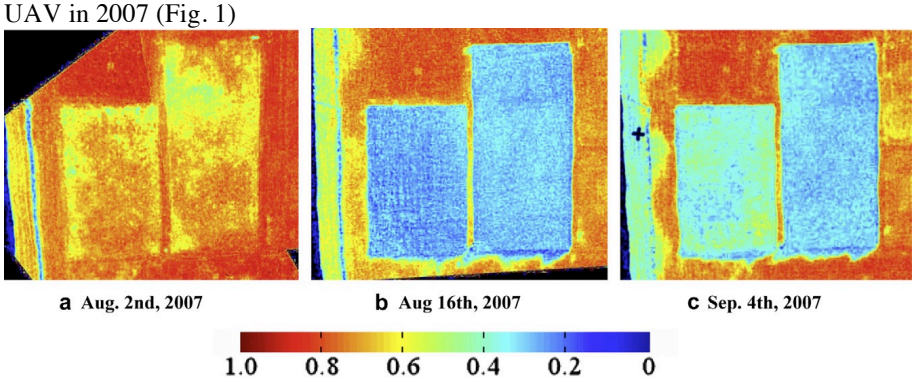

Fig. 1. Pseudocolor NDVI map for the turf grass field on 3 dates in 2007. Source: (Xiang & Tian, 2011).

Jannoura, R. et al., conducted a research in 2015 to evaluate crop biomass over a field with peas and oats. An RGB digital camera was adopted on a remote - controlled hexacopter (Fig.2) and, based on the aerial pictures, the Normalised Green - Red Difference Index (NGRDI) was calculated and related to aboveground biomass and Leaf Area Index (LAI). The Green - Red ration vegetation index (GRVI), the Normalised Difference Vegetation Index (NDVI) and the Visible Vegetation Index

(VVI) were also calculated in the research. ((Jannoura, R. et al., 2015)

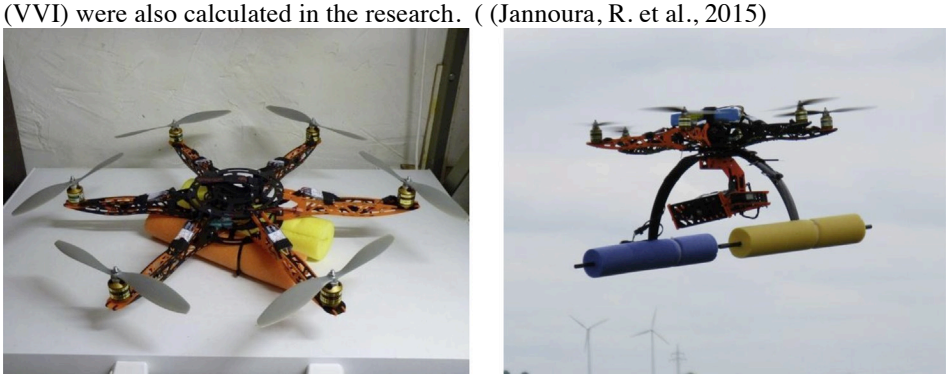

Fig. 3. e Hexacopter used to take low-altitude aerial photographs (Jannoura, R., et al., 2015)

6 Conclusion

Results of recent studies indicate that true colour images allow determining crop variation maps of an entire field. The results are encouraging for the development of UAVs as a tool for site-specific precision agriculture in a small field area given their low cost of operation. It is suggested that to provide a reliable end product to farmers advances in platform design are required and the farmer needs to be actively involved in image acquisition, interpretation and analysis in order to have reliable assistance in farm management decision making.

Data analysis has to be able to explain what is causing a variation in agricultural production, not just identify that there is a variation. The way forward for the industry now is to ensure that we can move from UAVs simply producing data to providing the agricultural industry with knowledge. We have to be able to produce high precision data that can improve farming in practice if UAVs are to become a key component of the agriculture industry. Predictions for the industry see growth over the next 2-3 years, with UAVs fully integrated into the agriculture sector within 5 years. By 2018 agricultural UAVs are also predicted to be cheaper, autonomous and a key part of the agriculture industry.

The future of precision agriculture is very exciting and the term Unmanned Aerial Vehicles (UAV) will eventually be referred to as Unmanned Aerial Systems (UAS) to correctly identify these highly engineered, safe and valuable tools that will increase profitability for future crop production.

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MUlticriteria Satisfaction Analysis Application in the Health Care Sector

Dimitrios Drosos[1], Nikolaos Tsotsolas[2], Athanasia Zagga[3], Miltiadis Chalikias[4], Michalis Skordoulis[5]

[1]Piraeus University of Applied Sciences, School of Business and Economics, Department of Business Administration, Business School, 250 Thivon & Petrou Ralli, Egaleo, Greece, e-mail: drososd@teipir.gr

[2]Piraeus University of Applied Sciences, School of Business and Economics, Department of Business Administration, Business School, 250 Thivon & Petrou Ralli, Egaleo, Greece, e-mail: ntsotsol@unipi.gr

[3]Piraeus University of Applied Sciences, School of Business and Economics, Department of Business Administration, Business School, 250 Thivon & Petrou Ralli, Egaleo, Greece, e-mail: athanstell@hotmail.com

[4]Piraeus University of Applied Sciences, School of Business and Economics, Department of Business Administration, Business School, 250 Thivon & Petrou Ralli, Egaleo, Greece, e-mail: mchalikias@hotmail.com

[5]Piraeus University of Applied Sciences, School of Business and Economics, Department of Business Administration, Business School, 250 Thivon & Petrou Ralli, Egaleo, Greece, e-mail: mskordoulis@gmail.com

Abstract. During the last decades the interest of health scientists has been increasingly focused on patients' needs, the quality of the services offered and the satisfaction level from the available health care. The measurement and evaluation of patient satisfaction is a milestone for the improvement of the services provided – procedures, given that these results can provide a useful variety of information and data that will lead to a high level of health services. For the purpose of this project the results presented concern a measurement of the satisfaction level of patients treated by the Greek Red Cross and more specifically by a service called "Nursing at home". For the collection of the data, questionnaires were used in order to better record the patients' views on the health care service overall as well as their satisfaction levels on particular aspects of the service. The analysis of the results has been based on the multicriteria MUSA method, which is part of the wider category of aggregation - disaggregation approach and is based on the principles of qualitative analysis regression.

Keywords: Customer Satisfaction, Quality Services, Health Care Sector, MUSA, Multicriteria Analysis.

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1 Introduction

It is common practice in the context of modern medicine, that increasing emphasis is given to the patients' opinion on matters associated with the quality of services as well as the satisfaction level that derives from them. The quality as well as the measurement of the satisfaction levels concerning the offered health care is a powerful evaluation tool for these specific services. The patients, as end users of health care services contribute with their participation to a qualitative improvement provided that the data produced is evaluated sufficiently. Specifically, the recording of patients' views on health care services combined with results from clinical studies can provide solid conclusions for the operation of different health organisations and levels of health care.

During the last decade, an increasing interest in measuring patient satisfaction levels has been noticed, and is certified by a number of studies that have been conducted on the health care systems of Britain, France, Sweden and the United States. The worldwide interest on measuring patient satisfaction levels has been empowered by the need for evaluation and improvement on the quality of health services (Bond and Thomas, 1992).

The international context shows new and innovative ways of organizing and administrating health organizations, the so called managed care. According to Pothos et al. (2014), "managed care deals with the development of healthcare programs that integrate into a single organizational structure both funding and providing healthcare packages". By this way the quality in the provided health services may be achieved.

Another tool for quality assurance in health is benchmarking, the continuous and systematic process of comparing an organization's performance, actions, practices and policies to the so called best in the world, a managerial process which can be useful in: (a) organization's management, (b) costs reduction, (c) business strategy development, (d) services time reduction and (e) insured individuals' services improvement (Pothos et al., 2014).

The concept of patient satisfaction has been presented in the international bibliography as a reliable index for the evaluation of health policy results; it is directly linked to the sufficient satisfaction of the general and particular health needs. In the USA, in 1990, the institute of medicine included patient satisfaction, as an important part of the outcome of health care, in the definition of the dimensions of quality. Although patient satisfaction research projects are not easy or simple due to their nature, they offer multiple benefits. They may contribute to the efforts made for quality improvement enabling the identification of low quality health care services as well as an evaluation on a national level that will contribute to the formation of the appropriate strategy.

The aim of this study is to present an original customer satisfaction survey in the health care sector and especially in the Greek Red Cross. This paper is organized into 7 sections. Section 2, presents the literature, regarding customer satisfaction, service quality in the health care sector. In section 3 a short description of Greek Red Cross is given.

Section 4 presents the MUSA (Multicriteria Satisfaction Analysis) method, which is the Decision Support System that was used in order to measure the customer

satisfaction. Section 5 presents the methodological frame and section 6 the results of our research. Finally, section 7 the conclusions and limitations are presented along with managerial and research implications of the study finding.

2 Literature Review

2.1 Customer Satisfaction and Service Quality

Customer satisfaction, according to Yi (1991), is fixed with two basic ways: "as a result or, as a process; the first way determines the satisfaction as a final situation or as a result of experience of consumption or use of product or service". Customer satisfaction is central to the marketing concept, with evidence of strategic links between satisfaction and overall service performance (Truch, 2006).

According to Bartikowski and Llosa (2004) "customer satisfaction is typically defined as an overall assessment of the performance of various attributes that constitute a service". There are lots of definitions for satisfaction. According to Engel and Blackwell (1982) satisfaction is an evaluation process, which examines whether this choice is consistent with previous convictions of the client.

Satisfaction is the reaction of consumers in the evaluation process, which examines the discrepancies between prior expectations and actual performance level of the product as perceived by the consumer after use (Tse and Wilton, 1988). As explained by Oliver (1996), Gerson (1993) and Vavra (1997), satisfaction is a measure of how the total offered product or service fulfills customer expectations.

Over the last two decades, service quality has been an essential strategic component for firms attempting to succeed and survive in today's fierce competitive environment. The main function an organization's members must perform is the delivery of quality service to its customers (Parasuraman et al., 1985; Reichheld and Sasser, 1990; Parasuraman et al., 1988). The most common definition of service quality, nevertheless, is the traditional notion, in which quality is viewed as the customer's perception of service excellence. (Berry et al., 1985).

Service quality is the customers' attitude or global judgment of a company's service over time, while customer satisfaction refers to a specific business transaction (Lam and Zhang, 1999). Parasuraman et al., (1985) defined ''service quality'' as the degree and direction of discrepancy between a customer's perceptions and expectations. Parasuraman et al., (1988), in their study with title "A multiple-item scale for measuring consumer perceptions of service quality" defined service quality as "a global judgment or attitude relating to the overall excellence or superiority of the service".

Based on this concept, Parasuraman et al., (1988, 1991) identified the following five generic dimensions of service quality (SERVQUAL) that must be present in the service delivery in order for it to result in customer satisfaction: Reliability, Responsiveness, Assurance, Empathy, and Tangibles.

2.2 Customer Satisfaction & Service Quality in the Health Care Sector

Over the last two decades, one of the fastest growing and competitive industries in the service sector is the health care industry. (Dey et al., 2006). Buyers of health care services are better educated and more aware than in the past. They know exactly what they need. They carefully monitor and study the health care options available to them. (Wadhwa, 2002). The customer satisfaction in the health care services has been measured by different researchers under varied environment. The health care organisation wants to know how satisfied their patients' are in order to be translated into organisation strategy and development.

Andaleeb (1998) stated that "hospitals that fail to understand the importance of delivering customer satisfaction may be inviting possible extinction". Patients, in general, receive various services of medical care and judge the quality of services delivered to them (Choi et al., 2004). Carr-Hill (1992), mentioned seven dimensions that determine patient satisfaction as follows: access, choice, information, readiness, safety, value for money and equity. In the health care sector, customer satisfaction leads to favourable results, such as higher rates of patient retention, positive word of mouth and higher profits (Peyrot et al., 1993; Zeithaml, 2000).

Hall and Dornan (1998) developed a patient satisfaction method that includes dimensions such as humanness, informativeness, overall quality, overall technical competence, beaurocratic procedures, access, cost, physical facilities, continuity, outcomes, handling of non-medical problems. Hasin et al., (2001), in their study demonstrated that the health care organisations have a good level of overall service, there are many areas that need attention to further improve the service.

Aragon et al., (2003) conducted a research in emergency department of hospitals and suggested the primary provider theory to measure patient satisfaction considering three latent variables: physician service (SP), waiting time (SWT) and nursing care (SN). A study conducted by Safavi (2006) has revealed that patient satisfaction includes dimensions such as dignity and respect, speed and efficiency, comfort, information and communication and emotional support.

Last years in Greece, there has been an increasing interest from for measuring the quality and the customer satisfaction in the health care services. Kalogeropoulou (2011) revealed that the general profile of the hospital is affected by the cleanliness conditions of stay and quality of the food. Patients require specialized anthropocentric healthcare services, and demand satisfaction of their basic rights, such as receiving information, giving consent and respect of their individuality.

Niakas et al., (2004), made a patient satisfaction survey with a self-administered questionnaire of 1295 adult patients.

This survey show high rates for medical and nursing services and fair rates for hotel services and facilities. The medical-nursing index (which can range from 0 to 100) shows a mean of 86.4 and the rate for the hotel services was 75.9. Matis et al., (2009) developed a patient satisfaction method that includes 5 dimensions: Medical, hotel facilities, organizational, nursing and global patient satisfaction.

The results reveal a relatively high degree of global satisfaction (75.125%), yet satisfaction is higher for the medical (89.721%) and nursing (86.432%) services. Moreover, satisfaction derived from the hotel facilities and the general organization was found to be more limited (76.536%). In their recent survey, Papagiannopoulou et

al., (2008) found that children's escorts were more satisfied that they had expected to be. The hospital personnel and specifically the medical and nursing services were highly rated, improving the general profile of the hospital. Conversely, the children's escorts' satisfaction was negatively affected by the hospital substructure.

Baralexis and Sophianou (2005) mention that public hospitals managers should realise that in order to confront effectively the increasing competition of private Greek hospitals, they should first measure the quality of their services in order to improve their performance. Matis et al., (2010) to another patient satisfaction, revealed a high degree of global satisfaction (73.31%), yet satisfaction was higher for the medical (88.88%) and nursing (84.26%) services. Moreover, satisfaction derived from the accommodation facilities and the general organisation was found to be more limited (74.17%).

As the number of health care organisations increases, competition in health care industry becomes tough and service quality becomes an imperative (Ennis & Harrington, 2001) to provide patient satisfaction and gain competitive advantage in the market because delivering quality service directly affects the customer satisfaction.

According Lim and Tang (2000) argue that customer based determinants and perceptions of service quality play an important role when choosing health care organisations. Wisniewski and Wisniewski (2005) in their study with title "Measuring service quality in a hospital colposcopy clinic" mention that service quality from the patients' perspective should be routinely monitored and assessed. On the other hand Silvestro (2005) proposes that the development of a tool for measuring the gap between patients' priorities and their perceptions and the match between the patient and management perspective.

3 About the Greek Red Cross

The Greek Red Cross was founded on 10 June 1877 following an initiative by Queen Olga. It was immediately recognised by the International Committee of the Red Cross and is now a member of the "family" of the International Red Cross and Red Crescent Movement. During its long history it has remained committed to international humanitarian principles and voluntary help to fellow human beings.

The Greek Red Cross is the largest non-governmental organisation in Greece, with a complex mission based on voluntary action and direct response by citizens. Its aim is to relieve human suffering in time of war and peace, supporting the wounded, the sick, refugees, the elderly, the poor and people from every vulnerable population group. Its actions are based on vigilance, solidarity and altruism, and it is synonymous with disinterested service and selflessness. The basic aims of the Greek Red Cross are:

- In time of war: the support and reinforcement of the Military Health Service, provision of medical treatment to the sick and wounded, and the protection of prisoners of war, the civilian population and war victims.

- In time of peace: the provision of relief and assistance to victims of disasters and epidemics, and humanitarian activities on an individual basis or in collaboration with the State and social services.

One of the main services offered by the Hellenic Red Cross is "Nursing at Home." The "Nursing at Home" service is an autonomous nursing care unit, aimed for patients leaving the hospital and for whom it is considered necessary to continue treatment at home. The Service has a specialized team of scientists consisting of Nurses – Health Visitors, doctors and physiotherapists who visit and monitor patients, supporting them and their families. The relatives are trained and supported to care for the member in need. This way every patient gets the chance to be treated in his own space, amongst his relatives and simultaneously contributes to the decongestion of hospitals and reduction of hospitalization costs.

4 The MUSA Method

The MUSA (Multicriteria Satisfaction Analysis) method of Grigoroudis and Siskos (Grigoroudis and Siskos, 2002; Siskos and Grigoroudis, 2002) has been chosen to be used in order to measure customer satisfaction in this research. The basic principle of MUSA is the aggregation of individual judgements into a collective value function, assuming that customer's global satisfaction depends on a set of criteria representing service characteristic dimensions (Figure 1). The global satisfaction is denoted as a variable Y and the set of criteria is denoted as a vector $\mathbf{X} = (\mathbf{X}_1, \mathbf{X}_2,\ldots,\mathbf{X}_n)$. MUSA was chosen over other statistical, econometrical methods because it gives reliable answers to the following criticism of other methods, namely:

1. Most of the statistical models that are used to analyze consumers' behavior cannot deal with qualitative variables, and whenever this happens, the variables are a priori encoded which results to a loss of the information provided by the consumer.
2. In several methods strong hypotheses are concerned which is difficult to be proved. These hypotheses may refer either to consumer behavior or to the estimation model (e.g. satisfaction assessment using a specific probability function).
3. Many methods focus mostly on the description of the characteristics which affect customer's satisfaction and not on the synthesis of these characteristics to a global satisfaction index.
4. Finally, several methods need information which is difficult to be collected (e.g.: customers' expected utility, tradeoffs, etc)

This preference disaggregation methodology is implemented through an ordinal regression based approach in the field of multicriteria analysis used for the assessment of a set of a marginal satisfaction functions in such a way, that the global satisfaction criterion becomes as consisted as possible with customer's judgments (Jacquet-Lagreze and Siskos, 1982; Siskos, and Yannacopoulos, 1985). According to the survey, each customer is asked to express his/her own judgements, namely his/her global satisfaction and his/her satisfaction with regard to a set of discrete criteria, representing characteristics of the provided products and services. Based on

these assumptions, the problem is approached as a problem of qualitative regression and solved via special linear programming formulations where the sum of deviations between global satisfaction evaluation expressed by customers and the one resulting from their multicriteria satisfaction evaluations is minimized. The main results from the aforementioned preference disaggregation approach are focused on global and partial explanatory analysis.

Global explanatory analysis lays emphasis on customers' global satisfaction and its primary dimensions, while partial explanatory analysis focuses on each criterion and their relevant parameters separately. Satisfaction analysis results, in more detail, consist of:

- Global satisfaction index: it shows in a range of 0-100% the level of global satisfaction of the customers; it may be considered as the basic average performance indicator for the organisation.
- Global demanding index: it shows in a range of -100%-100% the demanding level of customers according to the following:
  - demanding index 100%: extremely demanding customers
  - demanding index 0%: "normal" customers
  - demanding index -100%: non-demanding customers
- Criteria/sub-criteria satisfaction indices: they show in a range of 0-100% the level of partial satisfaction of the customers according to the specific criterion/sub-criterion, similarly to the global satisfaction index.
- Weights of criteria/sub-criteria: they show the relative importance within a set of criteria or sub-criteria.
- Demanding indices: they show in a range of -100%-100% the demanding level of customers according to the specific criterion/sub-criterion, similarly to the global demanding index.

5 Methodology - Criteria Selection

This research process consists of the steps below (Hayes, 1992):

- Preliminary analysis: Customer satisfaction research objectives should be specified in this stage; preliminary market and customer behavioural analysis should be conducted in order to assess satisfaction dimensions (customers' consistent family of criteria).
- Questionnaire design and conducting survey: Using results from the previous step, this stage refers to the development of the questionnaire, the determination of survey parameters (sample size, collection data form, etc.) and the survey conduction.
- Analysis: The implementation of the model is included in this stage providing several results as described in the previous paragraph. Analysis is performed into the total set of customers, as well as into distinctive customer segments. Provided results involve basic descriptive statistical models, as well as the multicriteria preference disaggregation MUSA model.

- Results: Using the results from the analysis stage, final proposals for organization's improvement strategy can be formulated; a reliability testing process for the results of the model is also included in this stage.

The results presented in this paper come from a satisfaction survey. For the implementation of this survey a structured questionnaire was developed. The items of the questionnaire are the outcome of a literature review, researchers' visits to the Greek Red Cross patients' and a qualitative analysis at the stage of pretesting. The survey was conducted within the period October – November 2011. Final input data consist of 305 questionnaires. The main satisfaction criteria for the survey consist of:

- Services: Satisfaction from the Greek Red Cross services.
- Nursing Staff: This criterion measures the satisfaction that a patient gains when communicating with the nursing staff of Greek Red Cross.
- Patient service: Refers to patient satisfaction from the Greek Red Cross services

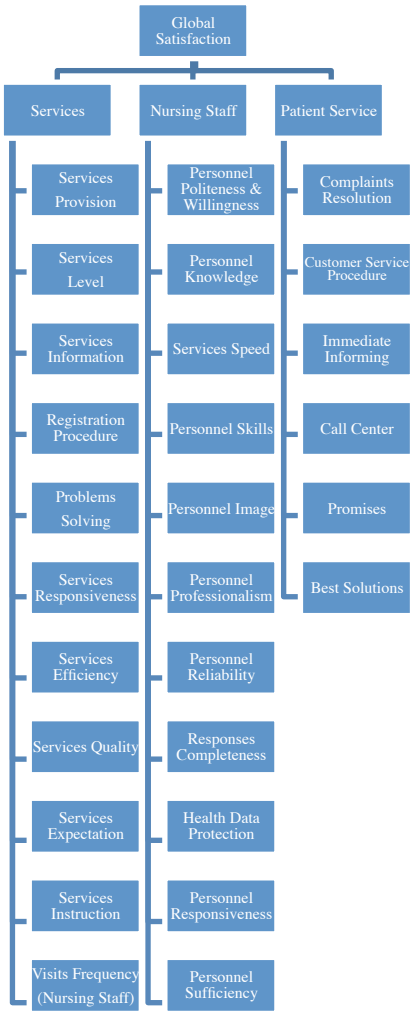

Fig. 1. Hierarchical structure of Customers Satisfaction Dimensions**.**

The set of satisfaction criteria in this survey is based on bibliographical research. Many researchers (Grigoroudis et al., 1999, Tsintarakis et al, 2001, Grigoroudis and Siskos, 2010, Michelis et al., 2001, Krassadaki et al., 2002, Manolitzas et al., 2010) introduce questionnaires in order to measure the customer satisfaction in several different sectors like banks, shipping, airlines, food & drinks, information technology and the public sector. Each of the 4 criteria above is divided into sub-criteria, which appear in figure 2.

6 Results

6.1 Sample

The sample selected with random sampling and constituted patients of Greek Red Cross. A total number of 203 answers from patients were collected, which provided the input data of the analysis. All the information about our sample demographic characteristics are presented in table 1.

Table 1. Sample Information

		Percent (%)
Gender	Male	31%
	Female	69%
Age	<24	4%
	25-34	7%
	35-44	8%
	45-54	12%
	>55	69%
Educational Level	Illiterate	12%
	Primary School	30%
	Lower Secondary School	15%
	Upper Secondary School	21%
	Graduate	22%
Family Status	Single	22%
	Married	13%
	Married with children	59%
	Divorce	6%
Income Level	No Income	6%
	< 300 €	5%
	301 - 500 €	12%
	501 - 700 €	25%
	701 – 900 €	23%
	> 900 €	29%

Due to the fact that only 61 of the patients have used the web site of Greek Red Cross the fourth criterion concerning the satisfaction from the web site has not been included in the satisfaction analysis process in MUSA method.

6.2 Satisfaction Analysis Results

The results given by MUSA method show that patients seem to be totally satisfied from the quality of the services that are offered by Greek Red Cross. More specifically, the average total satisfaction indicator amounts to 99.62% (fig. 2). Additionally, the concave form of total satisfaction function values in combination with the size of the estimated demand indicators, which are -64% (fig. 4), indicate

that patients are not particularly demanding, which means that they are easily satisfied even if only a part of their expectations is fulfilled.

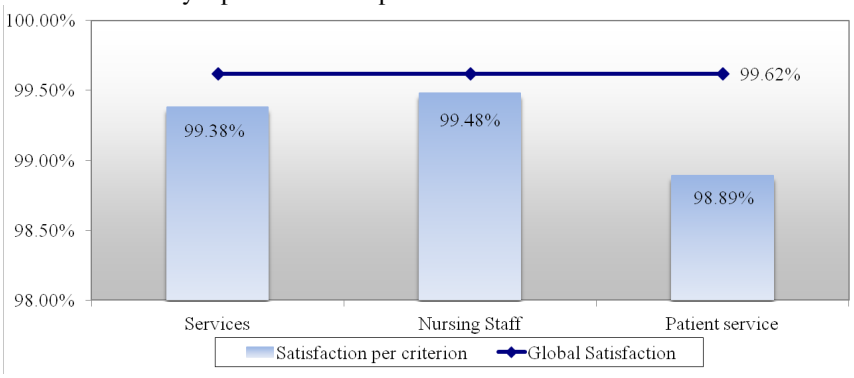

Fig. 2. Global & Partial Satisfaction indices

Regarding the patients' partial satisfaction from the quality of provided services, the highest satisfaction level is assigned to Nursing Staff (99.48%) and the lowest to Patient Service (98,89%). The weight of each criterion shows the degree of importance that given by the total number of tourists in each of the dimensions of satisfaction. Thus, is determined the level of importance of each criterion in the formulation of global satisfaction. Fig. 4 shows that the most important criterion is Services (40%).

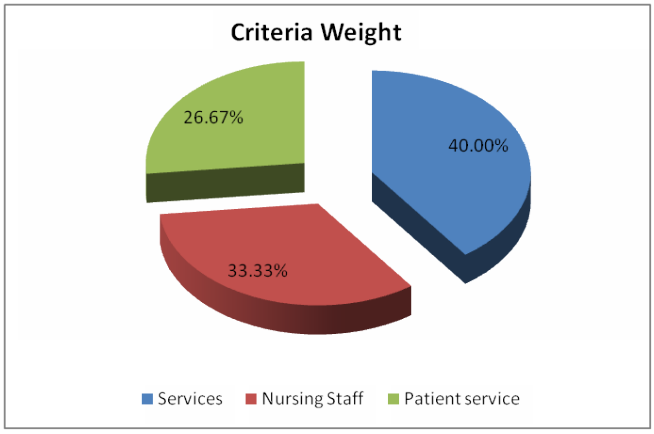

Fig. 3. Criteria Weights

Fig. 4 is coming to confirm the initial results regarding the demanding level of patients on the basis of the form of the global satisfaction function and the degree of the average total demand index. In particular, patients are less demanding regarding the Services, which is the criterion with the highest level of importance.

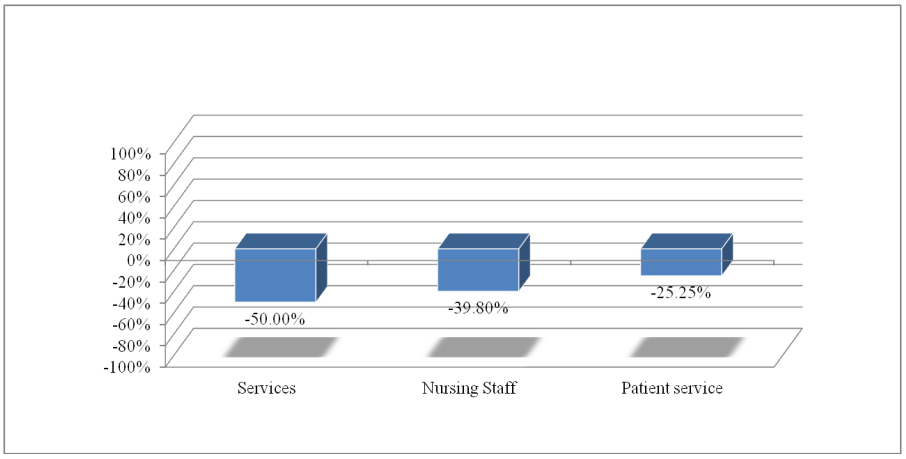

Fig. 4. Average demanding indices

MUSA results regarding the basic criteria can also help in the formulation of an action diagram through the combination of weights of satisfaction criteria with the average satisfaction indicators. Thus, the strengths and the weaknesses of the patients' satisfaction can be determined and also where any improvement efforts should be focused.

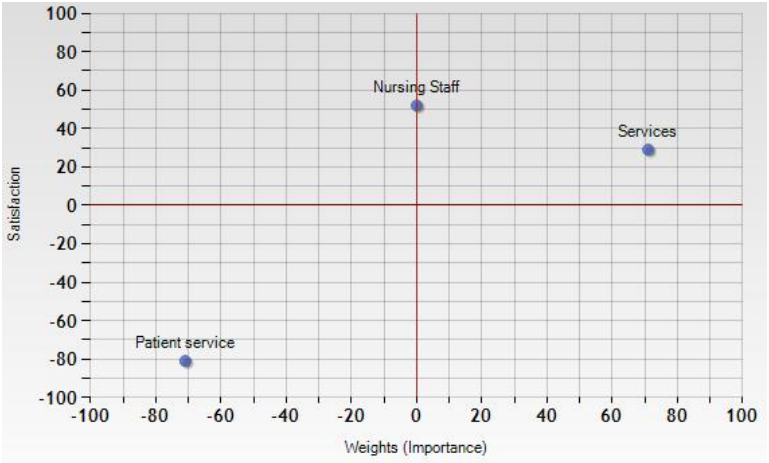

Fig. 5. Action diagram

According to the action diagram (Fig. 5) none of the criteria fall in the action area (high importance-low performance). This means that there were no important criteria in which patients are dissatisfied. Furthermore, the criterion of Services falls in the leverage opportunity area, so this criterion may be considered as the competitive advantage of Greek Red Cross which should be further improved and promoted.

6.3 Correlation between Satisfaction, Demographics and Loyalty

Trying to examine the correlation between the satisfaction, demographics and loyalty, we investigated the extent to which the patients' satisfaction level (overall, as well as partial on the criteria) is related to the personal demographic characteristics and/or to the loyalty of the patients as this loyalty is expressed in two questions ([i. willingness to continue the program], [ii. proposing the program to other patients]). For the evaluation of the aforementioned correlation we chose to use two measures depending on the nature of the scale of each variable:

- Chi-square test for nominal demographic variables
- Spearman's correlation coefficient for demographic ordinal and loyalty variables

The demographic variables which were filled in the questionnaire were: gender, age, education level, family status and annual income.

Table 2. Chi-square test – Gender and family Status

	Criteria	**X^2**	**df***	**Significance**
Gender	Global Satisfaction	0.642	2	0.725
	Services	1.742	2	0.419
	Nursing Staff	0.13	1	0.908
	Patient Service	1.022	2	0.600
Family Status	Global Satisfaction	7.525	6	0.275
	Services	**11.957**	**6**	**0.063**
	Nursing Staff	2.312	3	0.510
	Patient Service	8.384	6	0.211

* degrees of freedom

The chi-square (X^2) test of two independent samples along with the corresponding crosstabulations, which was conducted, showed that there is no association between the Gender or the Family Status and the patients' satisfaction level (see table 2) with only one exception: There is an indication that the satisfaction criterion of Services is related to the Family Status at the level of 6.3% (see table 2). Based on the corresponding crosstabulations one can conclude that the patients who are married and have no children appear less satisfied than the rest of the patients as far as the satisfaction criterion Services is concerned.

From the performed Spearman's rank-order correlation analysis, which was conducted, it was concluded that the Annual Income is negatively correlated with the patients' satisfaction level (see table 3) as far as criterion Patient Service is concerned. Furthermore, a strong positive correlation is observed between the two loyalty questions on one side and Global Satisfaction and satisfaction on criterion Services on the other side. A weaker positive correlation is observed between both question of loyalty and the satisfaction on criterion Nursing Staff.

Table 3. Spearman's rho

	Criteria	Spearman's rho	Significance
Age	Global Satisfaction	-0.097	0.168
	Services	0.065	0.355
	Nursing Staff	0.095	0.178
	Patient Service	0.131	0.062
Education level	Global Satisfaction	0.073	0.301
	Services	0.015	0.834
	Nursing Staff	-0.064	0.362
	Patient Service	-0.091	0.198
Annual income	Global Satisfaction	-0.133	0.059
	Services	0.011	0.877
	Nursing Staff	-0.105	0.137
	Patient Service	**-0.154***	**0.028**
Willingness to continue the program	**Global Satisfaction**	**0.936****	**0.000**
	Services	**0.195****	**0.005**
	Nursing Staff	**0.171***	**0.015**
	Patient Service	0.119	0.092
Proposing the program to other patients	**Global Satisfaction**	**0.979****	**0.000**
	Services	**0.201****	**0.004**
	Nursing Staff	**0.172***	**0.014**
	Patient Service	0.119	0.090

7 Conclusions - Future Research

The presentation of this study is an attempt by researchers to present a measurement of the satisfaction level of patients treated by the Greek Red Cross and more specifically by a service called "Nursing at home". The results reveal a relatively high degree of global satisfaction. More specifically, the average total satisfaction indicator amounts to 99.62%. Regarding the patients' partial satisfaction from the quality of provided services the highest satisfaction level is assigned to Nursing Staff (99.48%) and the lowest to Patient Service (98,89%). Furthermore, a strong positive correlation is observed between the two loyalty questions on one side and Global Satisfaction and satisfaction on criterion Services on the other side.

A weaker positive correlation is observed between both question of loyalty and the satisfaction on criterion Nursing Staff. Future research will examine results of three successive surveys, attempting to evaluate also the relationship between customer (Patients') satisfaction and other organizational results. Future research in the context of the presented study should also focus on satisfaction benchmarking analysis, given the rapid changes of the socioeconomic conditions. Also, additional approaches may be combined for the validation of obtained results (e.g. advanced statistical tools) and the enhancement of the method (e.g. Kano's model).

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Session 11: Agro-Engineering & Human Resources

The Views of Residents for the Actions Taken Before, During and After a Forest Fire: The Case Study of Larnaca Prefecture in Cyprus Island

Paraskevi Karanikola[1], Stilianos Tampakis[2], Anastasia Paschalidou[3] and Anastasia Matoli[4]

[1]Department of Forestry and Management of the Environment and Natural Resources, School of Agriculture and Forestry, Democritus University of Thrace, Orestiada, Greece, e-mail: pkaranik@fmenr.duth.gr
[2]Department of Forestry and Management of the Environment and Natural Resources, School of Agriculture and Forestry, Democritus University of Thrace, Orestiada, Greece

Abstract. Forest fires are considered as a major and permanent threat for the forests of Cyprus. Every year, forest fires cause enormous and irreparable damage to forest ecosystems and in some cases threaten residential regions. The present work aims at studying the perceptions and attitudes of the residents of the prefecture of Larnaca with regards to the actions of the Cyprus Fire Department and the other Services of the Prefecture, before, during and after the fires. The research was conducted with a face–to-face questionnaire.

Keywords: Forest fires, forest risk communication, residents' perceptions, actions for prevention, suppression, recovery

1 Introduction

Forest fires constitute a persisting problem, with a rather upward trend during the last twenty years, for most Mediterranean countries, even though regulatory bodies have been investing more funds in strategies to prevent and mainly suppress them (Tampakis et al., 2005).

Furthermore, the tendency of people to live within or near forests or woodlands not only increases the risk of fire but also alters priorities in the appropriation of fire extinguishing means (Jaber et al., 2001; Tabara et al., 2003) thus constituting a serious problem for the fire fighting forces (Lindeckert and Alexandrian 1990; Tampakis et al., 2005; Ioannou et al. 2011).

In earlier years, the confrontation of forest fires was more effective, as the life and prosperity of the population was directly related to the forest (Tampakis and Karanikola, 2002). Nowadays, most of the citizens become passive spectators of the desperate situation around them and help the fire extinguishing forces only when the fire threatens their villages or some settlement which is related to them and their lands (Vounassis, 1999; Tampakis et al., 2005).

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Especially for the forests of Cyprus, fires are considered as a very big threat. Every year, forest fires cause irreparable damage to forest ecosystems and in some cases threaten residential regions. There are many factors that contribute to increased fire risk in Cyprus, such as the high temperatures and the prolonged drought periods, as well as the extremely flammable vegetation. The accumulation of biomass due to the abandonment of rural areas and the increasing tourism recreation in forested areas are also important factors which contribute to increased fire risk, especially during summer months (Boustras et al., 2008).

The aim of this paper is to investigate the views of the residents in the prefecture of Larnaca with regards to the actions taken by the Forest Department, the Local Services and the residents before, during and after a forest fire. Questions that seek urgent answers are:

(a) What preventive measures should be taken for mitigating the fire risk?

(b) What are the potential omissions/limitations and where does the Forest Department need to put more emphasis?

2 Research Methodology

The research was carried out with the application of a face-to-face structured questionnaire delivered in the province of Larnaca, an area located on the southern coast of Cyprus, with a population of 143,192 inhabitants, of which 59% live in the city of Larnaca, the third-largest city of Cyprus after Nicosia and Limassol (CYSTAT, 2011). The state forests in Cyprus cover an area of 163,529 ha, i.e. 17.74% of the total area of the island (Boustras et al., 2008).

Random sampling was applied for the sake of simplicity in the procedure. The population ratio that is also the impartial evaluation of the real ratio of the population p and the assessment of the standard error of the population ratio of the s_p without correction of the finite population as the sampling fraction is small, has been calculated using the formulae of simple random sampling. To calculate the size of the sample, pre-sampling was performed with a sample size of 50 individuals, based on the formulae of simple random sampling (where t=1.96 and e=0.048). Even though simple random sampling without off-reset was used, the correction of the finite population was skipped as the sample size n was small in relation to the population size N (Pagano et al., 2000). More specifically, the sample size was determined to 400 individuals. The data collection was carried out during the second semester of 2014. The ensemble of questions which were reported to the possible sources of information constitutes a multi-theme variable on which reliability analysis is applied. In particular, in order to test the internal reliability of the questionnaire (Frangos, 2004), the alpha co-efficient (or reliability co-efficient a-Cronbach) was used. According to Howitt et al. (2003) values of the alpha co-efficient ≥0.70 are considered satisfactory, while values >0.80 are considered very satisfactory. In practice, it is frequent that smaller reliability coefficients, that is values no bigger than 0.60, are also accepted.

In order to ensure reliability, the multivariate method of Factor Analysis was applied. Factor Analysis is a statistical method which aims to discover the existence

of factors which are common within a group of variables (Sharma, 1996). In particular, we used the method of Principal Components which is based on the Spectral Analysis of the variance table (correlation). Regarding the significance of the principal components, the criterion used was the one suggested by Guttman and Kaiser (Frangos, 2004), according to which, the limit for the collection of the appropriate number of the principal components is determined by the values of typical roots which are equal or higher to one. Furthermore, we also used the matrix rotation of the main factors applying the Kaiser's method of maximum variance rotation.

3 Results and Discussion

According to the Cypriot local authorities, all fires occurring (or expanding) within the State forest or within two kilometers from the boundaries of the State forest are classified as forest fires. The primary responsibility for them lies with the Department of Forests of the Ministry of Agriculture, Natural Resources and Environment (Boustras et al., 2007).

With regards to prevention, suppression and recovery of forest fires the inhabitants of the prefecture of Larnaka were asked to assess these actions of the Cyprus Department of Forests. In particular, the respondents evaluated the actions for the suppression of forest fires as very good (40.3%) and good (46.2%). Accordingly, the actions for prevention had good acceptance from the inhabitants (30.1% very good and 50.1% good), while the actions of recovery in the burnt areas faced lower acceptance (33.8% mediocre and 32.7% good) (Table 1).

Table 1. Actions of the Cyprus Department of Forests regarding forest fires

Variables		Very Good	Good	Mediocre	Bad	Very Bad	No answer
Prevention of forest fires	%	30.1	50.1	17.7	1.6	0.3	0.3
	s_p	0.0234	0.0255	0.0195	0.0063	0.0026	0.0026
Suppression of forest fires	%	40.3	46.2	11.4	1.3	0.5	0.3
	s_p	0.0250	0.0254	0.0162	0.0058	0.0037	0.0026
Actions for the recovery of burnt areas	%	21.8	32.7	33.8	9.4	1.3	1.0
	s_p	0.0211	0.0239	0.0241	0.0149	0.0058	0.0052

For the prevention of forest fires, fire outposts were manned during the fire season and patrolling was organized in various forest regions, not only within forests but especially along the forest delimitation line where most of the forest fires start (Boustras et al., 2008). In particular, the respondents acknowledged that the Cyprus Department of Forests often (33.2%) and sometimes (28.3%) manned the fire posts and patrolled along the forest delimitation line (often 34.3% and sometimes 28.3 %). Their view was more positive with regards to patrolling within the forests (often 40.0% and sometimes 29.4%)(Table 2).

Table 2. Residents'assessment of actions taken before, during and after the forest fires

	Variables		Very often	Often	Mediocre	Rarely	Never	No answer
A. Before the forest fires	There are patrols along the forest delimitation line	%	14.3	34.3	28.3	15.8	4.9	2.3
		s_p	0.0179	0.0242	0.0230	0.0186	0.0111	0.0077
	There are patrols within the forests	%	14.8	40.0	29.4	9.6	4.7	1.6
		s_p	0.0181	0.0250	0.0232	0.0150	0.0108	0.0063
	There are manned fire-outposts	%	18.4	33.2	29.1	10.9	4.9	3.4
		s_p	0.0198	0.0240	0.0232	0.0159	0.0111	0.0092
	The Department of Forests conducts vegetation removal-clearance in forests	%	17.7	35.1	28.8	11.2	4.2	3.1
		s_p	0.0195	0.0244	0.0231	0.0161	0.0102	0.0089
	Residents remove all dry greens from their farmland	%	13.2	32.7	31.7	16.1	4.4	1.8
		s_p	0.0173	0.0239	0.0237	0.0188	0.0105	0.0069
	There are recreational areas within the forests that attract visitors	%	43.9	37.1	15.3	1.3	0.5	1.8
		s_p	0.0253	0.0247	0.0184	0.0058	0.0037	0.0068
	Residents light fires to burn agricultural leftovers even if this is forbidden	%	34.3	40.5	18.4	4.2	1.6	1.0
		s_p	0.0242	0.0251	0.0198	0.0102	0.0063	0.0052
	Residents are educated –informed on how to deal with a forest fire	%	7.8	29.6	33.8	22.1	5.2	1.6
		s_p	0.0137	0.0233	0.0241	0.0212	0.0133	0.0063
	Residents built their residence within or next to the forest	%	22.1	35.8	26.8	12.7	1.6	1.0
		s_p	0.0212	0.0245	0.0226	0.0170	0.0063	0.0052
B. During the forest fires	The fire is dealt with along the forest delimitation line	%	18.7	37.7	27.5	8.1	3.6	4.4
		s_p	0.0199	0.0247	0.0228	0.0139	0.0096	0.0105
	The fire is dealt with within the forest	%	20.0	34.0	26.2	11.9	4.4	3.4
		s_p	0.0204	0.0242	0.0224	0.0166	0.0105	0.0092
	The fire is dealt with at the village edges	%	27.5	40.8	22.3	3.6	2.1	3.6
		s_p	0.0228	0.0251	0.0213	0.0096	0.0073	0.0096
	Residents participate in the extinguishing of the fires	%	51.4	32.2	9.6	3.9	1.3	1.6
		s_p	0.0255	0.0238	0.0150	0.0099	0.0058	0.0063
	There was participation of Services other than the Fire Service in the fires	%	51.7	32.5	10.9	3.1	0.8	1.0
		s_p	0.0255	0.0239	0.0159	0.0089	0.0045	0.0052
	There is requisition and mobilization of private fire extinguishing machinery	%	43.4	33.2	15.3	5.2	2.1	0.8
		s_p	0.0253	0.0238	0.0184	0.0113	0.0073	0.0045
	Trees are logged to create anti- fire zones	%	26.8	31.7	24.9	9.4	4.4	2.9
		s_p	0.0226	0.0237	0.0221	0.0149	0.0105	0.0085
	With the appearance of air fire extinguishing forces, ground forces stop operating	%	9.9	20.8	24.9	22.6	19.0	2.9
		s_p	0.0152	0.0207	0.0221	0.0213	0.0200	0.0085
	There is immediate evacuation of villages in case of danger	%	33.2	29.1	22.9	12.2	2.3	0.3
		s_p	0.0240	0.0232	0.0214	0.0167	0.0077	0.0026
C. After the forest fires	Reforestation took place when recovery failed	%	20.0	34.0	32.7	8.8	1.6	2.9
		s_p	0.0204	0.0242	0.0239	0.0145	0.0063	0.0085
	Residents participate in reforestation efforts	%	20.5	29.4	35.1	10.9	2.9	1.3
		s_p	0.0206	0.0232	0.0244	0.0159	0.0085	0.0058
	There is financial support for the people affected	%	10.1	27.3	37.9	19.0	2.6	3.1
		s_p	0.0154	0.0227	0.0248	0.0200	0.0081	0.0089
	Proposals for buying new fire extinguishing equipment took place	%	12.7	28.6	34.0	17.4	4.4	2.9
		s_p	0.0170	0.0231	0.0242	0.0193	0.0105	0.0085
	Grazing from farm animals took place in the greening burnt areas	%	11.9	22.6	33.0	20.3	7.3	4.9
		s_p	0.0159	0.0213	0.0240	0.0205	0.0133	0.0111
	The residents of burnt areas abandoned them	%	4.9	14.8	34.0	33.5	10.9	1.8
		s_p	0.0111	0.0181	0.0242	0.0241	0.0159	0.0068
	After a big fire jobs were created, especially in reforestation	%	6.8	11.4	27.0	37.7	13.8	3.4
		s_p	0.0128	0.0232	0.0227	0.0247	0.0176	0.0092
	There is appropriation of forest lands	%	12.2	19.5	34.8	22.1	7.5	3.9
		s_p	0.0167	0.0202	0.0243	0.0212	0.0135	0.0099
	Proposal for buying or exchanging private lands located in the forests took place	%	7.3	19.2	34.8	22.6	10.9	5.2
		s_p	0.0133	0.0201	0.0243	0.0213	0.0159	0.0113

The avoidance of accumulation of combustible material is a very important measure in the prevention of forest fires, as disrupting the continuity of combustible material prevents the spreading of fire (Kailidis and Karanikola, 2004). The respondents answered that the Cyprus Department of Forests often (35.1%) and sometimes (28.8%) conducted vegetation removal- clearance in public forests. Similar were the opinions on the removal of all the dry vegetation from their farmland, i.e. often for 32.7% of the cases and sometimes for 31.7%.

The residents also stated that recreation areas organized in the public forests very often (43.9%) and often (37.1%) attract more visitors. Although, Tampakis et al., (2005) consider that more visitations can cause more fires in the forests, this increase is mainly due to the rural abandonment and consequently due to the accumulation of fuel. The population that lives in the countryside is aged and very often, in order to clean the land, they light fires without being able to control them. In Spain, and Greece the current trend to burn the fields has been reported to increase (Velez, 1992; Karanikola et al., 2011). Similarly, the residents stated that the farmers very often (34.3%) and often (40.5%) light fires to burn agricultural leftovers, even if this is forbidden.

Younger people can more easily adopt modern methods through awareness building and training (Karanikola et al., 2011). As Baden (1981) makes clear, informing the public about causes and control of forest fires is important to their prevention. With regards to the existence of awareness building and training on how to fight forest fires, 29.6% said “often”, 33.8% “some times” and 22.1% “rarely”.

In Cyprus the suppression of a forest fire is usually done by ground personnel. Under certain conditions, aircrafts can contribute to combating fires but the final effort is made on the ground. Thus, the residents of Larnaca were asked how satisfied they were about the actions of the Forest Department within the forest and at the village edges. During the demographic development in many European and USA areas, people built their first or second residence near or within forests (Tokle, 1987). According to the residents of Larnaca this happened near or within the forests of their prefecture very often for 22.1% of the cases, often for 35.8% and sometimes for 26.8%. Respectively, the residents considered that the forest fires were successfully extinguished along the forest delimitation line (often 37.7% and sometimes 27.5%), and within the forests (often 34%, sometimes 26.2%), whereas for fires occurred at the edges of their villages the relevant percentages were 27.5% (very often) and 40.8% (often). According to Vounassis (1999), the citizens in Greece help the fire extinguishing forces only when the fire threatens their villages or some settlement which is related to them and their lands. Nevertheless, the residents of Larnaca reported that very often (51.4%) and often (32.2%) they participate to the suppression of forest fires. Also, Services other than the Fire Service, such as the Civil Defense Force, very often (51.4%) contributed to the suppression of forest fires. As the Forest Department and other public authorities don’t possess adequate excavating machinery, these were borrowed by the private sector. On this matter, the respondents declared that very often (43.4%) and often (33.2%) immediate requisition of private machinery was done by the government. One important reason

for this is to create anti-fire zones. With regards to this, 31.7% of the residents declared that often trees were logged to create anti-fire zones.

Traditionally, the confrontation of fires is performed manually, with portable tools and through the creation of infrastructure for the speedy detection of fire which ensures the quick putting out of fire. The arrival of mechanical means increases the probabilities for a successful confrontation of the fire. Pumps are widely used even when it is difficult to transport them to the areas needed. However, practice shows that fire protection teams tend to move back when the sound of the pump is heard, believing that the water will do the job without manual work being needed. The same often happens when bulldozers appear in the scene. The same pattern can be detected with regards to air fire-extinguishing forces (Murphy, 1990). This behavior was also evident in our survey, where the respondents stated that ground forces stopped fighting the fire when the aircrafts arrived. Specifically, 24.9% of the people declared that this happened sometimes, 20.8% often and 22.6% rarely.

According to the current legislation, after any fire the Forest Department is obliged to take measures for the protection of the natural generation and the burnt area and for the reforestation of the areas where no significant natural rebirth is expected. On this matter, 32.7% of the residents stated that reforestation by the Forest Department, when needed, happens sometimes (and 34% often). Similar were their views for the public participation in the reforestation efforts; 35.1% said that this happened sometimes, 29.4%, often and 10.9% rarely. For a successful reforestation the burnt area is necessary to be protected from grazing. According to the residents, some years after the fire the greening land was often (22.6%), sometimes (33%) and rarely (20.3%) grazed by stock animals.

A forest fire can cause damage to residences, fruit trees and animal stocking. 27.3% of the people answered that financial support were often provided to those who suffered losses, while 37.9% answered "sometimes". Agricultural areas face serious problems and the result is young people abandoning them (Myronidis and Arabatzis 2009). Nevertheless after disastrous fires the tendency to abandon the area is not bigger (Karanikola et al., 2011). On this issue, the respondents stated that in the prefecture of Larnaca only sometimes (34%) and rarely (33.5%) the burnt areas were abandoned. On the other hand, it was said that sometimes (27%) and rarely (37.7%) the fires created new opportunities for jobs.

It is common knowledge that in many areas globally the purpose of forest fires is the clear-cutting and then the appropriation of public forest land (Douros, 1991). Hence, the fire is a "weapon" for the removal of forest vegetation (Dimitrakopoulos, 1991). However, the forest cadaster that exists in Cyprus discourages arsonists to light fires for this reason. Nevertheless, the inhabitants of Larnaca answered that sometimes (34.8%) and rarely (22.1%) land appropriation took place after fires.

In the above variables reliability analysis was applied, after the appropriate checks were performed. The reliability co-efficient alpha was 0.861 and this result provided strong evidence that the grades of the scale are logically consistent.

Also factor analysis was applied and 8 factors were extracted. In Table 3 the loadings are given after rotation of the factors. Some of them constitute the correlation coefficients of the 8 variables with every one of the 8 variables extracted from the analysis.

Table 3. Table with factor burdens after rotation.

	Variables	Factor loadings							
		1	2	3	4	5	6	7	8
A. Before the forest fires	There are patrols along the forest delimitation line	**0.777**	0.047	0.119	0.107	0.157	0.104	0.128	-0.019
	There are patrols within the forests	**0.861**	0.133	0.146	0.002	0.112	0.037	-0.039	0.021
	There are manned fire-outposts	**0.770**	0.149	-0.010	0.121	0.084	0.164	0.057	0.088
	The Department of Forests conducts vegetation removal-clearance in forests	0.409	0.102	0.066	0.137	0.121	**0.649**	0.160	0.035
	Residents remove all dry greens from their farmland	0.087	0.047	0.129	-0.009	-0.034	**0.818**	0.032	0.028
	There are recreational areas within the forests that attract visitors	0.040	0.236	-0.021	0.179	0.161	**0.506**	0.048	0.390
	Residents light fires to burn agricultural leftovers even if this is forbidden	0.088	0.056	0.083	0.091	0.063	0.114	0.026	**0.839**
	Residents are educated –informed on how to deal with a forest fire	0.355	0.129	0.105	**0.425**	-0.167	0.158	0.201	-0.009
	Residents built their residence within or next to the forest	-0.096	0.246	0.006	**0.599**	-0.014	-0.142	0.352	0.187
B. During the forest fires	The fire is dealt with along the forest delimitation line	0.333	0.250	-0.008	**0.425**	0.033	0.080	0.314	0.050
	The fire is dealt with within the forest	0.324	0.064	0.032	0.081	0.076	0.029	**0.736**	0.118
	The fire is dealt with at the village edges	0.374	**0.477**	0.184	0.117	-0.026	0.138	0.345	0.110
	Residents participate in the extinguishing of the fires	0.001	**0.783**	-0.069	0.023	0.237	-0.081	0.031	0.069
	There was participation of Services other than the Fire Service in the fires	0.076	**0.827**	-0.078	0.006	0.112	0.126	0.003	0.034
	There is requisition and mobilization of private fire extinguishing machinery	0.158	**0.761**	0.099	0.156	0.033	0.016	0.011	0.001
	Trees are logged to create anti- fire zones	0.170	**0.581**	0.081	0.193	0.133	0.327	-0.003	0.020
	With the appearance of air fire extinguishing forces, ground forces stop operating	-0.152	-0.094	0.291	-0.001	0.255	0.282	**0.609**	-0.231
	There is immediate evacuation of villages in case of danger	-0.059	0.346	0.245	-0.102	**0.601**	-0.068	0.047	0.118
C. After the forest fires	Reforestation took place when recovery failed	0.326	0.060	-0.025	0.065	**0.696**	0.091	0.223	-0.013
	Residents participate in reforestation efforts	0.089	0.223	0.115	0.175	**0.713**	0.056	0.034	0.070
	There is financial support for the people affected	0.256	-0.014	-0.008	0.397	**0.450**	0.249	-0.305	-0.152
	Proposals for buying new fire extinguishing equipment took place	0.041	0.093	0.077	**0.698**	0.286	0.187	-0.135	0.100
	Grazing from farm animals in the greening burnt areas took place	0.205	-0.026	0.431	**0.568**	0.056	0.011	-0.025	-0.044
	The residents of burnt areas abandoned them	0.162	-0.047	**0.685**	0.208	0.070	0.131	0.047	-0.185
	After a big fire jobs were created, especially in reforestation	0.174	0.016	**0.667**	0.084	0.124	0.143	0.003	-0.253
	There is appropriation of forest lands	0.002	0.087	**0.785**	-0.023	0.035	-0.097	0.134	0.258
	Proposal for buying or exchanging private lands located in the forests	-0.024	0.026	**0.779**	0.022	0.032	0.071	0.038	0.254

The burdens given in bold show which variables were linked to each factor.

The bigger the loadings of the variable in each factor, the more this factor is responsible for the total variance to the grades within the variable under consideration.

The variables that 'belong' to every factor are those for which the loading (columns 1, 2, 3) is bigger (than 0.5) in this factor (Table 3).

The 1st factor (hereafter characterized as "preventive measures") comprises the 2 "patrolling" variables and "manned fire-outposts". The 6th factor (hereafter characterized as "vegetation and visitors' management" comprises the variables "vegetation removal-clearance in forests", "dry greens removal from the farmlands" and "recreational areas". The 8th factor (hereafter "burning of agricultural leftovers" includes only this variable. The 4th factor (hereafter "socialization of forest fires" consists of the variables "Information and education of citizens", "residences within the forests", "fires confronted along the forest delimitation line", "fire-fighting equipment" and "grazing of the burnt area". An interesting finding here is the fact that the residents try to stop fires at the forest delimitation line; their concern is to save their homes, rather than protecting the forests.

In the 7th factor (hereafter called "traditional ways of firefighting") the variables "fires confronted within the forest" and "with the appearance of air-fire extinguishing ground forces stop operating" are summarized. On the contrary, the 2nd factor (hereafter "integrated ways of confronting forest fires") includes the variables "fires dealt with along the village edges", "participation of other services", "requisition and mobilization of private machinery" and "anti-fire-zones". The 5th factor called "local communities and forest fires" consists of the variables "evacuation of villages", "residents' participation in reforestation", "financial support of the people affected", "reforestation at-play". The 3rd factor called "consequences of fires" comprises the variables "area abandoning", "job creation after the fire", "Encroachment of forest land" and "purchase or exchanging of private land within the state forests".

4 Conclusions

Fire constitutes the most serious danger for the forests of Cyprus, due to the lack of proper prevention measures. In particular the residents of Larnaca, with respect to the "preventing measures" group of actions, believe that the existence of manned fire outposts were not organized effectively but the patrols in the forests seem to hold a more positive view. Regarding the "vegetation management" group of actions, the residents also hold a negative view on the work made by the Forest Department to remove all the dry vegetation from the forests. They also consider that the majority of the residents don't remove the vegetation from their farmlands, a fact that raises extra concerns as the removal of combustible material is well-known as the most important way of protecting the forest from fire. Nevertheless, there seems to be reasonable awareness building among residents on how to confront forest fires.

Similarly, it becomes obvious that many farmers behave in undesirable ways when it comes to the burning of agricultural leftovers. Although it is not easy to change the behavior of aged people on the use of fire to the removal of leftovers, a possible way

to address this issue could be to promote a co-operation between the authorities and the farmers on how to control the burning of leftovers.

With regards to the actions taken after a forest fire the respondents view rather negatively the reaction of the Forest Department and of the general public in reforestation efforts. Also they are not absolutely satisfied about the financial support provided to the people affected. It is positive however that after a fire no major abandoning of the areas is reported.

On the whole, forests need to be protected not only from fire but also from other factors which contribute to their construction. The best way to guard the forests is their management with the creation of goods and services from them.

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Data Fusion of Proximal Soil Sensing and Remote Crop Sensing for the Delineation of Management Zones in Arable Crop Precision Farming

Xanthoula Eirini Pantazi[1], Dimitrios Moshou[2], Abdul Mounem Mouazen[3], Thomas Alexandridis[2], Boyan Kuang[4]

[1]School of Agriculture, Aristotle University of Thessaloniki, Thessaloniki, Greece, e-mail: renepantazi@gmail.com
[1]School of Agriculture, Aristotle University of Thessaloniki, Thessaloniki, Greece
[3]Environmental Technology and Science, Cranfield University, Bedfordshire, United Kingdom, e-mail: a.mouazen@cranfield.ac.uk
[4]Environmental Technology and Science, Cranfield University, Bedfordshire, United Kingdom

Abstract. The widespread application of precision agriculture has triggered the expansion of tools for data collection and geo referencing of productivity, soil and crop properties. The correct data fusion of soil and crop parameters is a complex problem due to the abundance of inter-correlated parameters which necessitates the use of computational intelligence techniques. This paper proposes the combination of common statistical approaches with Self Organizing Clustering for delineating management zones (MZ). By this, the management of the field related to the application of inputs is becoming more accurate since the relations of the soil and crop parameters are indicated in a more precise way.

Keywords: Self-Organizing Maps, k-means, satellite remote sensing, proximal soil sensing, clustering

1 Introduction

Precision agriculture is oriented to field management taking into account its spatio-temporal variability. Its extensive use has enabled the development of tools which are capable of collecting data about soil and crop status, productivity and geolocation of these properties. The quantity of generated data demands the use of information technology in order to derive decisions concerning the management of production based on crop variability. The most widely used approach to manage the variability of fields concerns the use of MZ. Each zone is treated with the suitable level of inputs (soil tillage, seed rate, fertilizer rate, crop protection). The term of 'MZ' in a field represents a sub-region inside the field that exhibits a relatively homogeneous grouping of yield-limiting factors, concerning the treatment regime of using single rate for this zone. The MZ are defined based on soil and yield measurements, probably over a period of years (Fraisse et al., 2001). Soil information can be

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effectively utilized to create 'stable' MZ which remain unaltered per field. The proper selection of parameters is regarded as a complicated task owning to the great amount of inter-correlated parameters. This leads to a nonlinear problem which can be tackled with nonlinear statistical methods and computational intelligence approaches. An improved characterization of internal variation of soil properties gives the ability to delineate MZ which reflect in a better way their true variation. Traditional soil sampling and laboratory analysis is currently not cost effective. Researches that have been recently conducted; have utilized various sensors for single soil chemical and physical attributes measurements aiming not only to decrease expenses but also to improve MZ delineation. Nevertheless, the soil-water-crop system is regarded as difficult to be characterized properly by using single property sensors (Adamchuk et al., 2004). Studies that have been lab-based, have demonstrated that the spectra of soil reflectance that originate from visible and near infra-red (vis-NIR) ranges can give direct and proxy estimations of various yield-limiting factors (Kuang et al., 2012) This success triggered the research into mobile vis-NIR sensors which would be capable of collecting soil reflectance data in situ (Shibusawa et al., 2001, Christy, 2008; Mouazen et al., 2005). These sensors are able to provide data of high resolution on soil. Prediction models have been formed by associating reflectance spectra with soil samples tested in laboratory which were obtained from the survey. These prediction models can provide local prediction maps of specific soil properties (Kuang & Mouazen, 2011). Remote sensing of vegetation has been used in Yatsenko et al. (2003) in order to estimate chlorophyll concentration from spectral data. Multi-sensor fusion is an approach that attempts to minimize the uncertainty of an estimated variable through combining data from sensors that provide observations from the entity or the phenomenon that is characterized by the mentioned variable (Boginski et al., 2012).

Data fusion of soil and crop data can be utilized for defining MZ (Taylor et al., 2003), because the data are gathered into clusters owning to similar affects between soil and crop data production mechanisms. The clusters can also formulate a starting point to discover the reasons that bring up yield variability (Reyniers, 2003).

In this study, the k-means algorithm is compared with the Self Organizing Map for delineating MZ. Further, a hybrid SOM algorithm is presented which forms clusters in combination with k-means. The hybrid SOM algorithm and k-means are compared in terms of cluster separation and MZ formation based on data fusion of Normalized Difference Vegetation Index (NDVI) and soil parameters.

2 Materials and methods

Normalized different vegetation index (NDVI) was utilized in order to the calculate crop cover and it was based on images taken by satellite which were taken two times: the first on the 2nd May and the second on the 3rd June of 2013. These satellite images were produced by Disaster Monitoring Constellation II (DMCII) for the Horns End field in the UK.

The processing workflow chain for crop NDVI is based on post-processed L1R or L1T (ortho-rectified imagery). In-band reflectance calibration was performed to

obtain surface reflectance using ArcGIS. NDVI was calculated using the equation: NDVI = (NIR-R)/(NIR+R), where NIR and R is the is reflectance in the near-infrared and red bands, respectively. NDVI data were resampled to a 5mX5m grid resulting in 8798 values. A combine harvester mounted sensor was responsible for collecting yield data.

The yield was interpolated at the same 5mX5m grid as the NDVI, resulting in 8798 values. After the harvest of 2013, a spectral reflectance study utilizing the on-line vis-NIR sensor platform (Mouazen, 2006) was conducted. It comprised of an AgroSpec mobile, vis-NIR spectrophotometer of fibre type (Tec5 Technology for Spectroscopy, Germany) that covered a 305-2200 nm. 60 soil samples were gathered from the low side bottom of the trench that was opened by the subsoiler to demonstrate lab-tested levels of specific yield-limiting properties i.e. pH, phosphorus (P), potassium (K), calcium (Ca), Magnesium (Mg), organic carbon (OC), moisture content (MC), cation exchange capacity (CEC), total nitrogen (TN). Partial least squares (PLS) regression analysis was applied to soil reflectance spectra and chemical analysis values aiming to develop soil property prediction models. In order to provide point predictions, every model was fed to the on-line survey data. The creation of suitable variograms was enabled by geostatistical analysis of the prediction results. These variograms were used to give the prediction maps through interpolation by kriging. Yield data which were collected during previous harvesting periods in 2011 and 2012 was subjected to interpolation by Inverse Distance Weighting (IDW) aiming to deliver a further map layer which was capable of indicating past field fertility variation. All interpolated map layers, which were produced from the data that were collected from yield-limiting soil properties, were fused with interpolated maps of NDVI which indicated crop cover and historical yield data from years 2011 and 2012. MZ delineation by using k-means and Self Organizing Maps were performed.

3 Results

3.1 Data Fusion by Clustering with k- means

The point coordinates and property values of soil parameters, NDVI and historical yields were inserted in a spreadsheet matrix for every experimental field and then imported into Matlab software. Clustering was achieved by using the k-means clustering algorithm (Hartigan and Wong, 1979), which utilizes the unscaled, squared Euclidean distances, so as to calculate the distance., A normalization process was followed in order to avoid that a property with large values will prevail over the clustering. Normalization consisted of mean centering, followed by division with the standard deviation of the samples. This normalization was performed in order to have zero mean data which are scaled between -1 and 1. The clustering procedure enables the data fusion from numerous properties. It delineates similarity areas by putting them in the same class. Firstly, the best number of classes was determined by

utilizing the gap criterion (Tibshirani et al., 2001). As regards Horn's End, the clusters were two and this was calculated by utilizing the "evalclusters" command in Matlab 2013b. This result corresponds to normalized attributes, where mean is centered and standard deviation equals to unity. In the case of non-normalized features the gap criterion is maximized for 8 clusters. The values of the GAP criterion referring to different numbers of clusters are shown in Fig.2. The result is the same when utilizing the NDVI with historic yields and soil parameters of the years 2011 and 2012 and when using only historic yields with soil parameters. Each input spreadsheet point was given an integer to show membership of a class. The acquired clusters by repeating the k-means algorithm between 2 and 7 clusters brought up the results that are demonstrated in Figure 1.

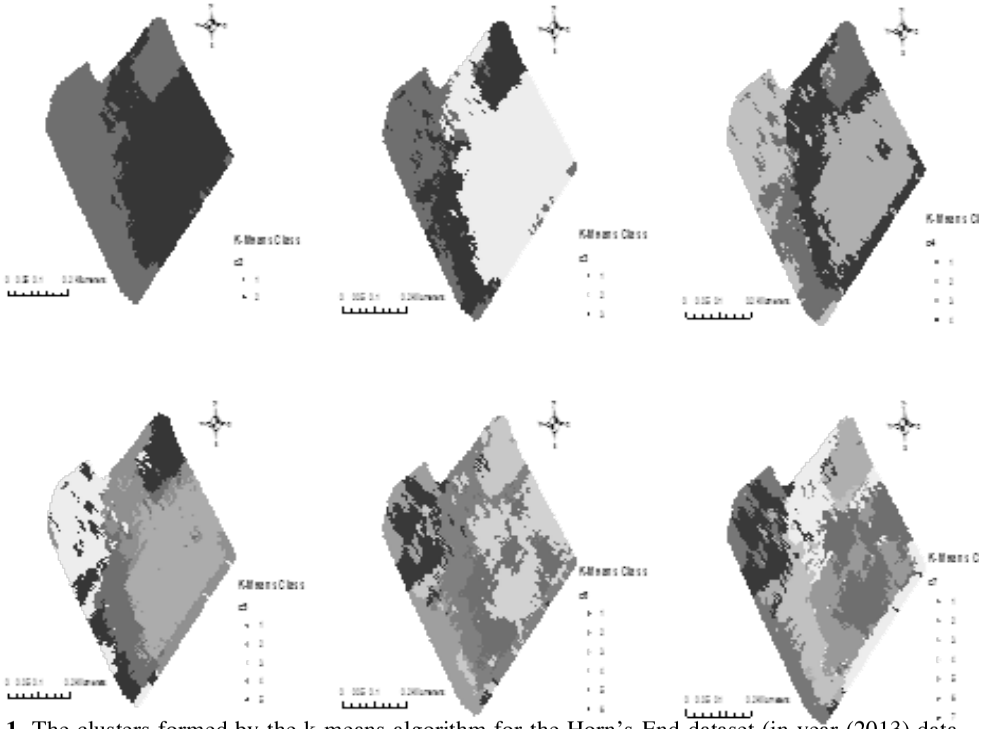

Fig. 1. The clusters formed by the k-means algorithm for the Horn's End dataset (in year (2013) data. The basic clusters are two while the left-side cluster is split in two further resulting in 3 clusters. The data presented here, is for clustering soil properties, NDVI and historic yield.

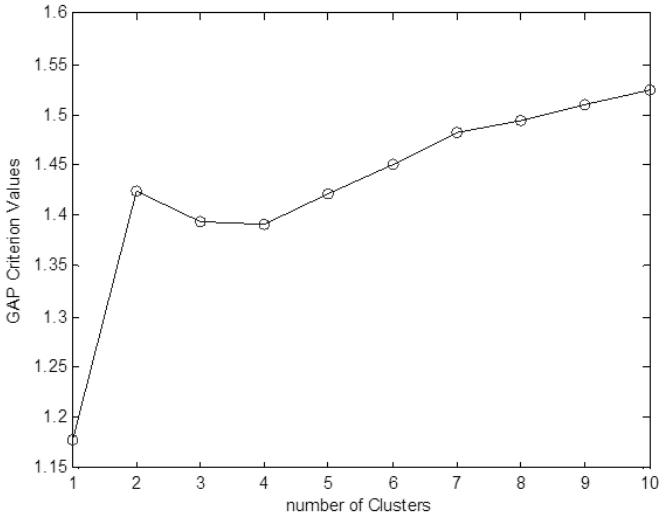

Fig. 2. GAP values for Horn's End

3.2 Data Fusion by Clustering with Self-Organizing Maps

The delineation of MZ by utilizing self-organizing maps (SOM) was achieved by using Matlab (Mathworks, Natick, MA, USA). The U-matrix was developed first before delineating MZ by applying the K-means algorithm on the U-matrix, resulting in MZ (Recknagel et al., 2006). The U-matrix represents the matrix of distances separating neighbors in the grid of SOM. The effectiveness of the U-matrix lays in its ability to visualize the neurons density in the data space by visual inspection of the distances between the clusters that neurons make in the weight space. In order to create maps of MZ, the sample data were supposed to belong to the group of neurons that are activated when these data are presented to SOM. The cluster formation seems to be clearer due to the fact that the SOM forms Voronoi polygons grouping similar vectors. Moreover, it gives a better view of the data microstructure letting the k-means to deal with higher level correlations of the data that is related to persistent phenomena which affect the data behavior. At this point, the clusters can be analyzed by U-matrix and dendrograms, as is shown in Figure 3.

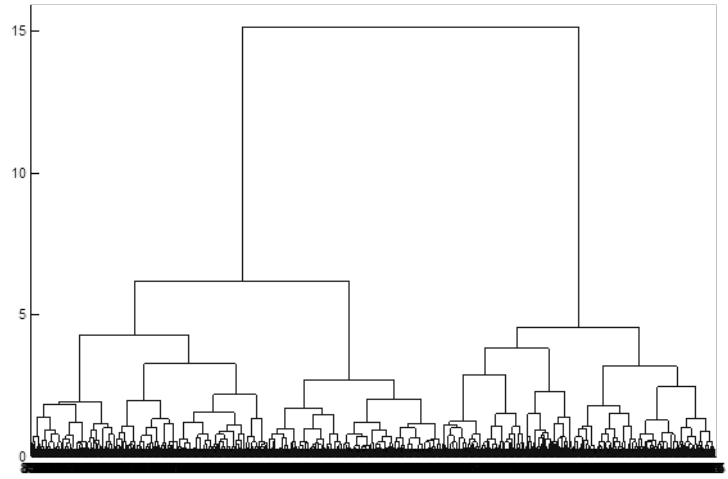

Fig. 3. The structure of the SOM clusters is shown in the dendrogram where for Horn's End – 2013 two major clusters are shown.

The k-means algorithm which is applied on top of the SOM clusters (Fig.4) demonstrates smoother interpolation of results as compared to the corresponding results produced with k-means clustering only which depend on the amount of Voronoi regions corresponding to the SOM neurons, forming the centroids of these regions. For example a 3x3 SOM with 9 Voronoi regions (polygons) results in the MZ maps shown in Fig.4.

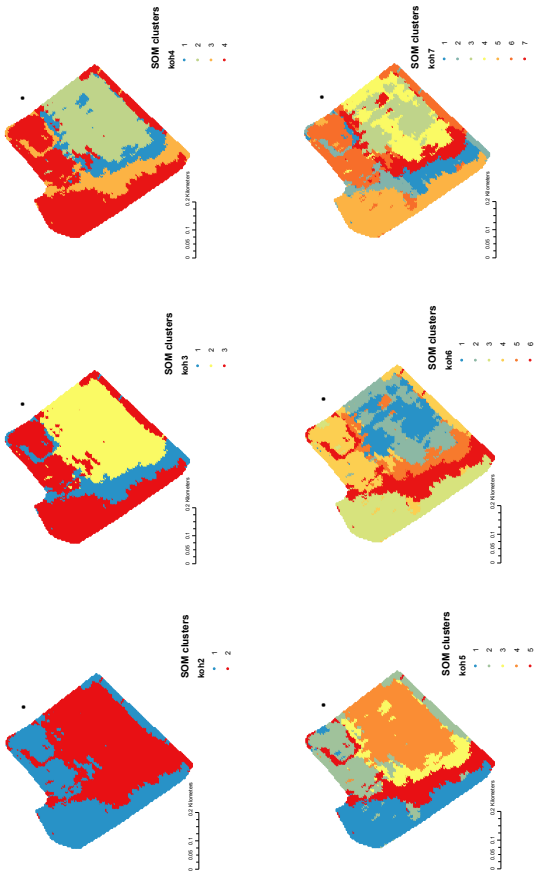

Fig. 4. The management zone maps produced by the combined self-rganizing map (SOM) with k-means algorithm for different number of clusters between 2 & 7. The basic clusters are two while the left-side of the field (blue cluster) is persistent during all subsequent segmentation indicating a serious anomaly in the data generation of physical phenomenon (probably also indicating a yield failure). This failure was due to water logging in this part of the field, where yield data were always low, although the soil fertility is high

In order to examine the goodness of separation between clusters resulting from the hybrid SOM and k-means clustering, the normalized mean plots for different variables can be examined. As can be seen from Figures 5 and 6, the normalized means exhibit a consistent trend for clusters with low yield in 2013 in both k-means and hybrid K-means and SOM clustering. However, in the case of the hybrid clustering, the normalized means of the soil parameters are well separated for all three clusters while in the case of k-means the topology of the means is distorted. This confirms the superiority of hybrid clustering regarding the separation between different classes compared to the corresponding K-means clustering.

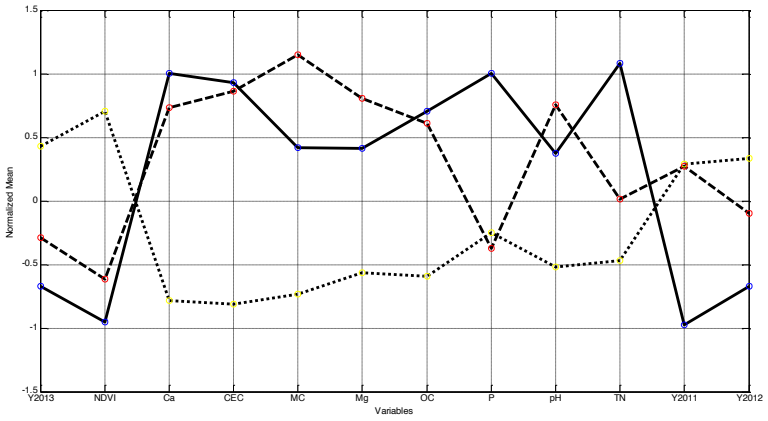

Fig. 5. Normalized means of K-mean Clusters

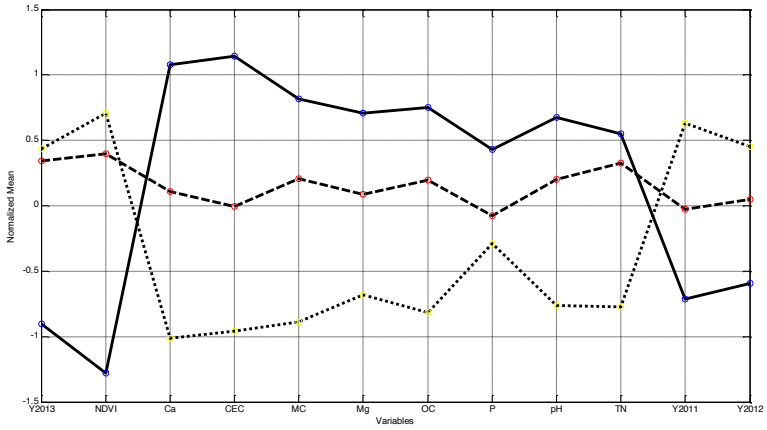

Fig. 6. Normalized Means of hybridSOM clusters (K-Means performed on SOM grid of neurons)

It is evident from the normalized means of the hybrid SOM clusters in Figure 6 that the low yield corresponds to high values of soil parameters. This can be explained from water logging problems in the corresponding areas of the field (left side of the field in Figure 4). The other two clusters demonstrate the inverse behavior where consistently lower values of soil parameter mean value relate to higher yields in 2013. This explains that although the soil fertility is high, the water logging problem prevents obtaining a good yield, whereas a lower level of soil fertility could result in a better yield when the soil is well-drained. A similar behavior can be observed concerning the NDVI, which seems to be highly correlated with the yield in all three clusters. The behavior of the yield is also consistent with yields of 2011and 2012.

4 Discussion

The cluster centers of the hybrid SOM and k-means algorithm show better separation of clusters when compared with the standard k- means algorithm. The cluster formation is clearer since the SOM forms Voronoi polygons grouping similar vectors and thus obtains a better view of the microstructure of the data allowing the k-means to deal with higher level correlations of the data related to persistent phenomena affecting the behavior of the data.

5 Conclusions

In this paper, the combination of common statistical approaches with Self Organizing Clustering for delineating MZ is presented. By this way, the management of the field related to the application of inputs is becoming more accurate since the relations of the soil and crop parameters are indicated in a more precise way. The soil parameters have been predicted based on proximal soil sensing utilizing high resolution spectral measurements and satellite based NDVI sensing. The obtained data layers have been fused and the point vectors have been subjected to clustering. The k-means algorithm is compared with the Self Organizing Map for delineating MZ. Further, a hybrid SOM algorithm is presented which forms clusters in combination with k-means. The hybrid SOM algorithm and k-means are compared in terms of cluster separation and MZ formation based on data fusion of Normalized Difference Vegetation Index (NDVI) and soil parameters. The cluster centers of the hybrid SOM and k-means algorithm show better separation of clusters when compared with the standard k- means algorithm.

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Farmers' Involvement in Online Public Consultations and the Corresponding Configuration of the Democratic Divide

Maria G. Botsiou[1], Vassilios Dagdilelis[2], Stavriani Koutsou[3], Vasiliki Karavakou[2], Vagis Samathrakis[4]

[1]Department of Educational and Social Policy, University of Macedonia, Greece, e-mail: m_botsiou@yahoo.gr, mbotsiou@uom.edu.gr
[2]Department of Educational and Social Policy, University of Macedonia, Greece
[3]Department of Agricultural Technology, Alexander Technological Educational Institute of Thessaloniki, Greece, e-mail: skoutsou@farm.teithe.gr
[4]Department of Accounting and Financial, Alexander Technological Educational Institute of Thessaloniki, Greece, e-mail: sbagis@acc.teithe.gr

Abstract. The institution of online public consultations was adopted in Greece in 2009 (www.opengov.gr.) Participation or non-participation of citizens in this institution constitutes part of the digital divide, referred to as democratic divide. This paper attempts to disclose components of the democratic gap in the Greek agricultural sector, with particular reference to farmers. This disclosure is attempted by two approaches. The first approach was to perform content analysis on 5078 comments that have been posted on 21 public consultations by the Greek Ministry of Rural Development, in order to identify the participation frequency of farmers. The second approach was part of wider research, and relates to the collection of primary data from 112 farmers of Heraklion, Crete, using a structured questionnaire. The objective of the second approach is to study the farmers' digital and socio-professional profiles and the correlation with their awareness about the institution of online public consultations. The results indicate the existence of a democratic divide, and identify proposals for its reduction.

Keywords: Digital divide, democratic divide, online public consultation, farmers.

1 Introduction

2500 years ago, the institution of Ecclesia originated in Ancient Athens. This institution was the main democratic assembly of the city-state, where the political issues of the time where put to debate. The main feature of the Ecclesia was the direct participation of the citizens in the legislative and judicial procedures of the city-state.

Today, ICTs represent a kind of reintroduction of the Ecclesia into the political process, serving the need to redefine the relationship between state and citizens, to

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restore confidence between them. A survey by Transparency International in 64 countries showed that political parties are seen as the most corrupt institutions in the world (Transparency International, 2004). Especially in Greece, citizens strongly question the role of political parties and are doubtful about their usefulness as representational and promotional bodies for citizens' aspirations (Transparency International, 2004:9). Tapscott (2000:303) argued that democracy in many countries of the modern world is stagnant because governments, in their entirety, appear inefficient and remote. The social consequences of the above, define the need for open dialogue and an exchange of views between governments and citizens. In this context the institution of online public consultations was adopted.

2 e-Democracy

Since the early 90s, the implementation of information and communication systems in the operation and organization of the public sector and government has brought significant changes to the organization and functioning of states (Robison & Crenshaw, 2002). Thus, in political terminology there appear terms such as e-government and e-democracy (Bellamy, 2003; Lasse et al., 2006). The shift by states in technology to broaden democracy coincides with the social need for a redefinition of the relationship between governments and citizens. The use of ICT in an effort towards open and public policy is applied more and more often as a means of redefining this relationship (Kingham, 2003; Hoff, 2004; Ward & Lusoli, 2005; Welch et al., 2005; Tolbert & Mossberger, 2006; Kikuchi, 2007). The redefinition of this relationship is defined as a need both by the observed decline in the interest of citizens in politics (McAllister, 2002; Dahlgren 2009) and by the weakening of public confidence in politicians and institutions (Gibson et al., 2004; Parent, 2005).

The United Nations define e-Government as the permanent commitment of the government to improve relations between citizens and the public sector through the effective and efficient provision of services, information and knowledge (Durrant, 2002:101). In this context, the power of online public consultation has already proven to be a means to influence citizens to government policy (Botsiou, 2011).

However, the overall efficiency of online public consultation is related to the existence of the democratic divide. Norris (2001:4) defines the democratic divide as the third form of digital divide, and is described as the difference between those people who use ICT for their participation in public life, and those who do not. In countries where voting is not compulsory firstly, and secondly vote only by electronic means, the democratic gap is widening between those who have access to ICT and technology insiders, and those that do not have these privileges. This element can result in an abnormal reflection of public opinion in online public consultations, while creating a new type of economic and political elite which, through ICT access privileges, will be able to exercise effective influence in shaping government policy, promoting in this way their own interests.

As an expansion of democracy, the institution of online public consultations was established in Greece in 2009 (www.opengov.gr). Through this institution, 475 public consultations have been performed until now, and 127,205 comments have

been posted (OpenGov, 2015). The Greek Rural Development Ministry conducted 21 consultations, on which 5078 comments have been posted. This paper studies the democratic divide in the Greek agricultural sector, and particularly for farmers.

3 Research

3.1 Aim and Objective

The purpose of this study is to investigate the democratic divide in the agricultural sector, especially in relation to the institution of public consultations. The study was conducted in two phases. At first, the 5078 comments posted in 21 public consultations by the Greek Ministry of Rural Development were analyzed in order to identify the frequency of participation of Greek farmers in these. Then, personal interviews were conducted using structured questionnaires with farmers of the Heraklion prefecture (Crete, GR). The objective was to study their digital features, but also to ascertain if they were aware of the institution of online public consultations. The interviews took place in April 2015 and numbered 112.

3.2 Methodology

As mentioned above, the study was conducted in two phases. At first, the 5078 comments posted in 21 public consultations by the Greek Ministry of Rural Development were analyzed in order to identify the frequency of participation of Greek farmers in these. According to Coleman (2004:2), in order to be effective, the study of public consultations should apply a combined analysis system on the quantitative and qualitative axes. So it was necessary to use methods to permit a pooled study of the comments on the axes of quantitative and qualitative analysis. The methods chosen were Content Analysis and Text Semiotics. To ensure the validity of the results, the following were defined as attributes: i) the systematic basis of criteria which clearly define the decision on whether data from the content of the comments is to be included in the analysis or not, data constituting the commentator's occupation in the online public consultations, and consisting of researchers in this decision; and ii) the assurance of validity and reliability through rules to guarantee the reappearance of identical results when repeated on the same content. Based on the above, if the commentator's occupation was not explicitly mentioned by him, then it resulted from the content of the comment. For example: "[…] Unfortunately, I am still waiting for the registration notification […] due to my authorization as a new farmer" (comment posted on 2010-04-19 18:40:21h).

In the second phase of the survey, interviews were conducted using a structured questionnaire on a sample of 112 farmers (Heraklion Prefecture, Crete, GR). The municipal district selection, which was drawn in the survey sample, followed the methodology of proportional stratified random sampling, based on four criteria that

are described below. Then, sampling of the population within those municipal districts, was based on random sampling.

The first criterion for the selection of municipal districts, of which the sample was drawn, was its level of urbanization. As the study related to farmers, it was decided to select rural municipal districts. According to the Greek Statistical Authority, rural districts are those whose population is less than 2000 inhabitants. According to data from the Population Census 2011, the districts of Heraklion Prefecture numbered 479. In all these, 3 are classified as urban, 20 as semi-urban and 466 as rural (population up to 1,999) (Table 1). Thus, the first criterion of the sample selection drew a distinction of 466 districts.

The second criterion for municipal district selection was its hilliness coefficient. The Greek Statistical Authority provides hilliness coefficient data for 182 of the 466 districts of Heraklion Prefecture, and therefore the selection of the sample was limited to 182 of 466 districts. Amongst these 182 districts, 89 are lowlands, 45 are semi-mountainous and 48 mountainous (Table 1).

Table 1. Criteria 1&2: Urbanization and hilliness coefficient

Hilliness Coefficient *	Urban** Frequency	Semi-urban** Frequency	Rural** Frequency
Lowlands	3	4	89
Semi-mountainous	0	3	45
Mountainous	0	3	48
No data available	0	0	284
Total (hilliness coefficient)	3	10	182
Total	3	10	466

Source: Compilation of data from the Greek Statistical Authority
* Pre-census data (1980 reference year)
** Population census data 2011

The third criterion for municipal district selection was the exclusion of very small districts, as they do not have supporting infrastructures (schools etc.). Based on the census of the year 2011, 89 out of 182 municipal districts of Heraklion Prefecture had more than 300 inhabitants (i.e. 48.9%). The hilliness coefficient of these 89 municipal districts is about 48 lowlands, 21 semi-mountainous and 20 mountainous (Table 2).

The fourth criterion was the municipal districts' inclusion in the broadband network. Based on the GIS Broadband Map (Hellenic Telecommunications & Post Commission, 2015), 72 of the 89 districts have access to the broadband network (i.e. 80.89%), 39 of the 48 lowland districts have access to the broadband network (i.e. 81.25%) and 14 of the 20 mountainous districts have access to the broadband network (i.e. 70.00%) (Table 2).

Table 2. Criteria 3&4: Municipal districts with a permanent population >300, hilliness coefficient, integration in broadband network

			Within broadband network		Outside broadband network	
Hilliness Coefficient	Frequency	%	Frequency	%	Frequency	%
Lowlands	48	53.9	39	81.3	9	18.7
Semi-mountainous	21	23.6	19	90.5	2	9.5
Mountainous	20	22.5	14	70.0	6	30.0
Total	89	100	72		17	

Source: Data synthesis from the GIS Broadband Map and 2011 population census.

Finally, it was decided to select 10% of these 89 municipal districts, which resulted in the four stratification criteria, i.e. 9 rural municipal districts (89*10%=8.9). Mutatis mutandis of hilliness coefficient and broadband (Table 2) selected: i) five (5) lowland municipal districts (9*53.9%= 4.8) four (4) of which have access to the broadband network (5*81.3%=4.065) and one (1) has not (5*18.7%=0.935), ii) two (2) semi-mountainous municipal districts (9*23.6%=2.1) that have access to the broadband network (2*90.5%=1.81), iii) two (2) mountainous municipal districts (9*22.5%=2.025) of which one has access to the broadband network (2*70.0%=1.4) and one (1) has not (2*30.0%=0.6).

The final decision on the selection of nine municipal districts of Heraklion prefecture was defined using the random number generator in an Excel program. The method of random sampling then followed, where 112 interviews were conducted using a structured questionnaire.

3.3 Content analysis of the online public consultations

In Greece, the institution of online public consultation was launched in 2009. Until today, 475 consultations have been carried out, 21 out of which by the Greek Ministry of Rural Development. In total, 5078 comments have been posted. These consultations are: (1) Changing the institutional framework for the integration and rehabilitation of the agricultural trade union movement; (2) Farmers' register; (3) Reconstruction of agricultural cooperative organizations of Greece; (4) Protection and security of agricultural activity; (5) Establishment of single registry of agricultural trade; (6) Framework law on pesticides; (7) Pets and stray animals, animal welfare from exploitation or use for profit; (8) Institutional framework for agricultural cooperatives, collective organizations and entrepreneurship of rural society - Organization of the state supervision; (9) Arrangements for livestock and livestock facilities; (10) Rational use of pesticides; (11) Health and safety of food and animal feed, animal health and animal welfare, management of animal by-products; (12) Integrated Crop Protection Guidelines I; (13) Integrated Crop Protection

Guidelines II; (14) Recommendation by the organization "Hellenic Agricultural Organization - DIMITRA"; (15) Management competence of the Ministry estate Rural Development; 16) Integrated Crop Protection Guidelines III; (17) Integrated Crop Protection Guidelines IV; (18) Aquaculture development; (19) Authorizing the marketing of plant protection products formulated for amateur use; (20) Organization and operation of ELGO-DIMITRA; (21) Integrated Crop Protection Guidelines V (Table 3).

Content analysis of the posted comments in these public consultations revealed 5 main groups of participants, based on the capacity in which, in a statement or content, they were consulted. These are: a) Farmer; b) Farmers' collective (professional, cooperative and trade unions); c) Scientist (agronomists, technologists agronomy, biologists, veterinarians, lawyers, surveyors); d) Collective scientific institutions (business, trade unions, learned societies, research groups); e) Other (public bodies and their employees, agricultural products traders (non farmers), commercial companies, environmental and animal welfare organizations, but also cases we were not able to identify). Note that, although there is substantial difference between professional associations and trade unions, in this paper it was not considered appropriate to make the distinction, as the subject of the research did not affect the quality of participation in the consultation, but its quantity (representation frequency of the agricultural sector).

Table (3) presents the results of content analysis of these 21 consultations. The first column of Table 3 shows the s/n of each consultation as it was presented in the first paragraph of this section. The second and third columns of Table 3 show the frequency of posted comments in each consultation and the relative frequency. The remaining columns concern the commentary frequency per occupation group. As can be seen from the table, in 14 of the 21 consultations, farmers or collective bodies thereof participated. Higher participation of farmers (relative frequency >10%) is displayed in consultations s/n 1 (43.4%), 2 (68.8%), 3 (36.1%), 4 (21.1%), 5 (41.2%), 8 (66.0%), 9 (11.5%), 17 (21.1%), 18 (16.6%). These consultations related to the integration and restructuring of the agricultural trade union movement, the farm register, the reconstruction of rural cooperatives in the system of protection and security of agricultural activity, the establishment of the single registry of dealers in agricultural products, regulations for animal husbandry, instructions on integrated pest management, and the development of aquaculture. The participation of farmers was nil in the consultations concerning the adopting and stray pets, in four consultations relating to guidelines for integrated crop protection, and in both consultations concerning the establishment of the Greek agricultural organization DIMITRA.

Table 3. Greek Ministry of Rural Development, public consultations: commentators grouping and participation frequencies.

S/N	Total comments	%	Farmers	%	Farmers coll. bodies	%	Scientists	%	Sci. coll. bodies	%	Other	%	Total %
1	113	2.2	49	43.4	7	6.2	19	16.8	0	0.0	38	33.6	100
2	80	1.6	55	68.8	3	3.8	11	13.8	0	0.0	11	13.8	100
3	36	0.7	13	36.1	9	25.0	11	30.6	0	0.0	3	8.3	100
4	38	0.7	8	21.1	1	2.6	28	73.7	1	2.6	0	0.0	100
5	17	0.3	7	41.2	0	0.0	0	0.0	0	0.0	10	58.8	100
6	59	1.2	5	8.5	0	0.0	46	78.0	4	6.8	4	6.8	100
7	2663	52.4	0	0.0	0	0.0	15	0.6	8	0.3	2640	99.1	100
8	47	0.9	31	66.0	1	2.1	8	17.0	0	0.0	7	14.9	100
9	200	3.9	23	11.5	1	0.5	51	25.5	29	14.5	96	48.0	100
10	130	2.6	8	6.2	10	7.7	65	50.0	11	8.5	36	27.7	100
11	962	18.9	20	2.1	23	2.4	196	20.4	8	0.8	715	74.3	100
12	14	0.3	0	0.0	0	0.0	14	100.0	0	0.0	0	0.0	100
13	3	0.1	0	0.0	0	0.0	3	100.0	0	0.0	0	0.0	100
14	235	4.6	0	0.0	0	0.0	174	74.0	29	12.3	32	13.6	100
15	136	2.7	3	2.2	9	6.6	67	49.3	0	0.0	57	41.9	100
16	28	0.6	0	0.0	0	0.0	28	100.0	0	0.0	0	0.0	100
17	19	0.4	4	21.1	0	0.0	12	63.2	0	0.0	3	15.8	100
18	199	3.9	33	16.6	37	18.6	21	10.6	1	0.5	107	53.8	100
19	6	0.1	0	0.0	0	0.0	6	100.0	0	0.0	0	0.0	100
20	80	1.6	0	0.0	2	2.5	35	43.8	39	48.8	4	5.0	100
21	13	0.3	0	0.0	0	0.0	13	100.0	0	0.0	0	0.0	100
Total	5078	100	259	5.1	103	2.0	823	16.2	130	2.6	3763	74.1	100

2.4 Fieldwork results

The sample consisted of 112 farmers, 101 of which were male, and 11 female (90.2% and 9.8% respectively). The age of the participants ranged from 20-78 years old, where 27.7% were under the age of 35, 36.6% aged 35-50, 32.1% aged 50-65, 3.6% older than 65 (Table 4).

Table 4. Farmers' age groups

Age group	Frequency	%
<35	31	27.7
35-50	41	36.6
50-65	36	32.1
>65	4	3.6
Total	112	100

Of the total participants, one person was illiterate (0.9%), 36.6% were elementary graduates, 21.4% middle school graduates, 30.4% high school graduates, 10.7% graduates of tertiary education (higher education). In total, 40.1% were at least high school graduates (Table 5).

Table 5. Farmers' educational attainment

Educational attainment	Frequency	%
Illiterate	1	0.9
Elementary	41	36.6
Middle School	24	21.4
High School	34	30.4
Higher Education	12	10.7
Total	112	100

Concerning ICT access, 88.4% of the respondents (i.e. 99 farmers) stated that there is access to a PC at home (including tablet and laptop), 33.9% declared themselves smartphone owners (Table 6). 94 of the 99 participants who declared that there is PC in their home, also have Internet access (broadband network or USB stick), while 1.8% do not know whether online access is available at home. In total, 112 participants 67 (i.e. 59.8%) declared themselves ICT users, while 40.2% had never used ICT.

Table 6. Farmers' access to and use of ICT

	PC at home (desktop, laptop, tablet)		Internet at home		Smartphone		Use of ICT	
Access or Use	Frequency	%	Frequency	%	Frequency	%	Frequency	%
No	13	11.6	20	17.9	74	66.1	45	40.2
Yes	99	88.4	90	80.4	38	33.9	67	59.8
Don't know			2	1.8				
Total	112	100	112	100	112	100	112	100

As mentioned in the previous table, 40.2% of respondents have never used ICT. Table 7 shows that in contrast to these 40.2%, 8.9% declared themselves ICT users in

the last year, 10.7% 1-3 years, 6.3% 3-5 years, 8.9% 5-8 years, and 25% have been ICT users for more than 8 years.

Table 7. Farmers' experience in ICT usage

Experience group (years)	Frequency	%
I do not use ICTs	45	40.2
<1 year	10	8.9
1-3	12	10.7
3-5	7	6.3
5-8	10	8.9
>8	28	25
Total	112	100

Regarding the participation of farmers in rural collective bodies, it appears that 65.2% of the sample are members of professional associations (cooperatives and producer groups) and 6.3% are also members of farmers' trade unions (Table 8). Of the total of 112 surveyed, 39 (i.e. 34.8%) are not members of a professional or trade union.

Table 8. Farmers' participation in rural collective bodies

	Professional Associations		Trade Unions	
Participation	Frequency	%	Frequency	%
Non-member	39	34.8	105	93.8
Member	73	65.2	7	6.3
Total	112	100	112	100

Regarding the participation of the sampled farmers in public consultations, it appears that 84.8% were not aware of the online public consultation (Table 9). Aware of the existence of the institution were 15.2%, of which 52.9% follow public consultations and 23.5% participate in them.

Table 9. Farmers' self-reference for public consultations www.opengov.gr

	Aware of P.C.		Follower		Annotator	
Self-reference	Frequency	%	Frequency	%	Frequency	%
Yes	17	15.2	9	52.9	4	23.5
No	95	84.8	8	47.1	13	76.5
Total	112	100	17	100	17	100

Correlations. The relationships among age, educational attainment, usage of ICT, experience in ICT, participation in professional and trade unions, and the overall

experience in the institution of public consultations, were examined using Pearson correlations. The awareness of the existence of the institution of public consultations shows a small positive relationship with educational level (r=0.300, p>0.01) and with experience in the use of ICT (r=0.326, p>0.01). A moderately positive relationship shows awareness of the existence of the institution of public consultations with participation in trade unions (r=0.405, p>0.01). This indicates that people who are members of a trade union are more likely to be aware of the existence of the institution than someone who has no trade union involvement. It is possible that the information on the existence of the institution spreads faster among trade union members than among members of professional organizations, since normally the role of trade unions concerns the preservation of vested interests and the promotion of collective interests, which is connected with the philosophy of the institution of public consultations. Finally there is strong positive correlation between awareness of the existence of public consultations and the following of and participation in these consultations (r=0.943, p>0.01). It is normal for farmers who do not know of the existence of this institution not to attend or participate.

Table 8. Correlations for Study Variables

Variable	1	2	3	4	5	6	7	8	9
1. Age	-								
2. Educational attainment	-.384**	-							
3. ICT use	-.323**	.470**	-						
4. ICT experience	-.367**	.557**	.852**	-					
5. Member in professional associations	.275**	-.262**	-.116	-.181	-				
6. Trade unionist	.051	.107	.153	.129	.189*	-			
7. Aware of www.opengov.gr	.059	.300**	.223*	.326**	-.004	.405**	-		
8. Following www.opengov.gr	.054	.312**	.259**	.363**	-.030	.341**	.943**	-	
9. Annotator in www.opengov.gr	.012	.307**	.235*	.343**	-.067	.366**	.937**	.944**	-

*p<0.05, **p< 0.01

4 Conclusion

The institution of online public consultations was introduced in 2009 in Greece (www.opengov.gr). Under this institution, the Greek Ministry of Rural Development has conducted 21 consultations, on which 5078 comments have been posted.

This paper does not aim to assess the involvement of farmers in electronic public consultation, in the sense of quality participation in the formulation of laws that

concern them, but the emergence of democratic divide probability within the rural world. These public consultations involve farmers and their collective bodies in a proportion that reaches up to 68.8%. It can be argued that participation rates of farmers and their collective bodies in public consultations are high, and indeed in many public consultations constitute the majority of commentators. However, field research revealed the existence of a democratic divide among farmers, as the vast majority of farmers do not know of the existence of the institution of electronic public consultations. Although the awareness of the existence of the institution of the farmers does not necessarily mean active participation in it, moreover participation is a personal choice of each farmer, consistent with the attitude to life, the information deficit of the existence of this institution is a structural expansion material the democratic divide.

The institution of electronic public consultation promotes the participation of citizens in shaping public policy and is part of a new form of democracy, e-democracy. Freedom of expression and formulation of ideas, thoughts and suggestions of citizens is the basis and foundation of any type democracy. The possibility of creating dialogue, not only between citizens and the initiator of the consultation, but also between the citizens themselves, gives the online public consultation a special dynamic feedback of ideas and policy. In this sense, the institution of electronic public consultation is an important rural development tool in the hands of farmers, element defines the need to reduce the democratic divide.

Within the context of closing the democratic divide in the agricultural sector, we propose to intensify the publicity of the public consultations institution, press releases to local communities and promotion in local and national media. We also propose the organization of seminars in the context of lifelong learning, in coordination with the informal lifelong learning schools of the municipalities, where we promote the ideal of the institution of public consultations.

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Efficiency Assessments for a Biomass Harvesting and Handling System

Anna Orfanou[1], Dimitrios Pavlou[2], Dionysis Bochtis[3]

[1]Department of Engineering, Aarhus University, Denmark, e-mail: annaorf@yahoo.gr
[2]Department of Engineering, Aarhus University, Denmark, e-mail: dmpavlou@gmail.com
[3]Department of Engineering, Aarhus University, Denmark, e-mail: dionysis.bochtis@eng.au.dk

Abstract. A simulation model, which depicts the harvesting operation of biomass supply chain, is presented in this paper. ExtendSim8 simulation software was used for the development of the model. There are a number of sequential operations, i.e. mowing, drying, baling, picking-up, loading, and transporting, for harvesting biomass until the final product arrives at bio-energy generation plant. Different scenarios, in terms of the operational system configuration, are analyzed in order to show how the operational time and cost are affected.

Keywords: Biomass supply chain, harvesting operations, simulation model, optimisation.

1 Introduction

The interest in new and renewable energy has been increased over the years because of the limited fossil fuel resources and the related caused environmental problems, such as atmospheric pollution. (Goldenberg, 2000; Richardson and Verwijst, 2007) Biomass utilization is important for energy production (McKendry, 2001; Veringa, 2006), such as electricity, heat and biofuels. The use of biomass is expected to be significantly increased in the future (Berndes et al., 2003; Yamamoto, 2001; Jager-Waldau and Ossenbrink, 2004), which is a great opportunity for agriculture, although there should be efficient ways for retrieving it from the field in order to maintain the operational cost at reasonable level (Sambra et al., 2008). Improvements in biomass supply chain should be done for minimizing not only the cost but also the time consumption. The demand and the use of biomass can be increased by several ways, such as new conversion technologies, better planning and handling systems etc. (Sambra et al., 2009).

New and improved ways are required for increasing the operational efficiency of agricultural operations especially in complicated production systems (Sørensen and Bochtis, 2010). Advanced management models, such as fleet management tools for operations of multiple machines in multiple fields are required in order to analyse these processes (Sørensen and Bochtis, 2010; Orfanou et al., 2011). Simulation

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models of a biomass supply chain are important for making the process more efficient by examine different parameters that can affect the process.

This paper refers to a simulation model of biomass supply chain, which consists of the operations of mowing, drying, balling, picking up, loading, traveling and unloading as it is shown in Fig. 1. The purpose of building the simulation model was for demonstrating the process of biomass supply chain and showing how different parameters can affect the whole process in terms of time and cost.

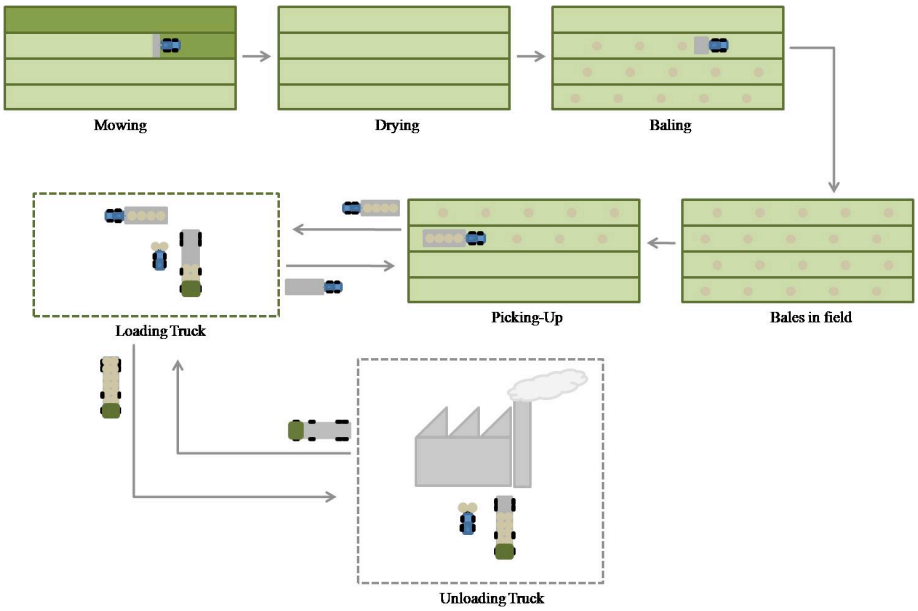


Fig. 1. Graphical representation of the biomass supply chain

2 Materials and Methods

A simulation model was created by using ExtendSim8 simulation software. A number of blocks were utilized for representing biomass supply chain. The activities (i.e. mowing, baling, loading, unloading, transportation) and resources (i.e. machines, labor) are represented by the blocks of *Item* library. The blocks that belong to *Value* library were used for importing data (inputs), making equations and taking decisions (e.g. to start an operation when the previous one is terminated). Furthermore, the blocks from *Plotter* library were used for the graphical representation of the results.

The inputs are separated into field data (e.g. field area, yield, etc.), machinery data (e.g. number and capacity of the machines in each task, etc.), and cost data (labor, fuel cost, etc.). The output of the simulation process provides the total time and the variable cost of the harvesting process according to different operational scenarios and a range of travel distances between the field and the bio-energy generation plant. It

shows also the identification of different bottlenecks for pick-up machine and truck in each scenario.

The architecture of the model is presented in Fig. 2. Every box in the diagram represents an activity and the constrain parameters of it. Inputs and outputs are presented by arrows on the left and on the right of each box respectively. The physical aspects of each activity are shown by the arrows at the bottom of each box.

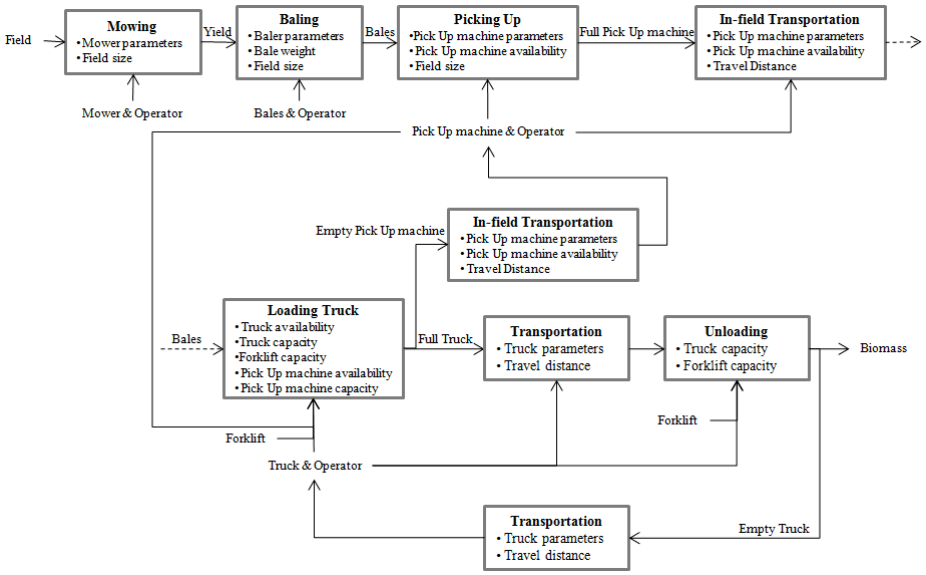


Fig. 2. Architecture of the simulation model

3 Implementation

In the presented case study, it is shown a harvesting process of crops for bio-energy production purposes. Mowing, baling, picking up, loading truck, transporting, and unloading truck, are the sequential operations of the system. Table 1 shows the parameters of the selected machines. In a field of 5 ha, different parameters of distance (5 km, 15 km and 25 km), number of trucks (1 and 2 trucks), and capacity of each truck (34 bales, 48 bales, 62 bales) were examined.

Table 1. Machinery Parameters

Machines	Repair factors[a]		List Price[b]	Fuel Cost (€/h)	Accum .Use (h/y)	Productivity (min/ha)	Capacity	Travel speed (km/h)
	RF1	RF2	(€)					
Tractor (150 hp)	0.003	2.0	60,000	-	1,000	-	-	-
Mower	0.44	2.0	15,000	11.89	400	42.00	-	-
Round Baler	0.43	1.8	32,000	14.18	400	65.00	-	-
Pick-Up	0.16	1.6	34,000	13.03	400	62.00	18	15.0
Forklift	0.40	1.7	9,000	8.46	400	17.86	2	
Truck	0.003	2.0	110,000	Full: 17.92 Empty: 12,46	1,750	-	48	51.5

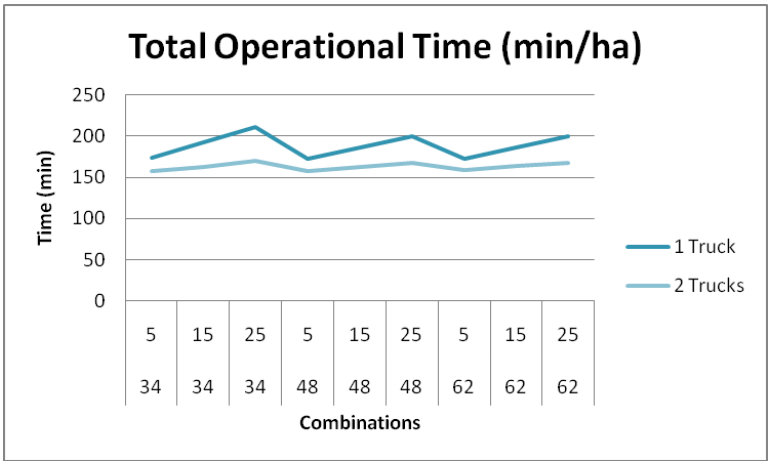
a: ASAE D497.5 (2006), b: DAAS (2011)

Table 2. Tested Scenarios for biomass supply chain

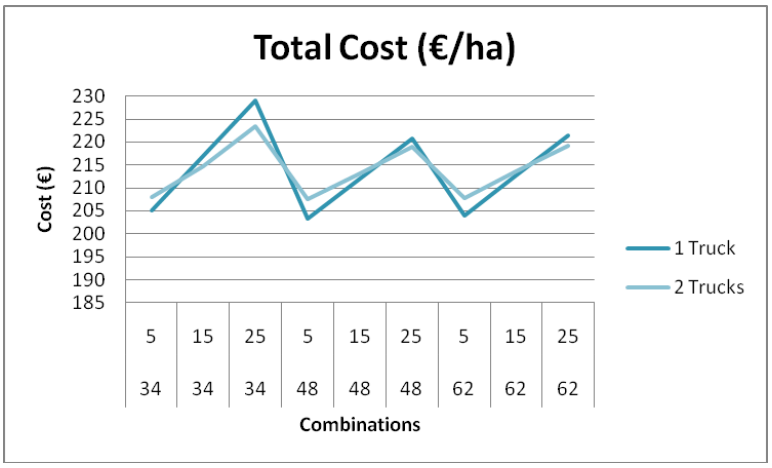
Number of Trucks	Capacity of each Truck (bales)	Travel Distance (km)
1	34	5
		15
		25
	48	5
		15
		25
	62	5
		15
		25
2	34	5
		15
		25
	48	5
		15
		25
	62	5
		15
		25

4 Results

Fig. 3 shows (a) the total operational time per ha and (b) the total cost per ha for the selected scenarios presented on Table 2. At the x axis (Combinations), the first row refers to the travel distances between field and bio-energy generation plant, while the second row shows the capacity of each truck.



(a)



(b)

Fig. 3. (a) Total operational time and (b) total cost of biomass supply chain

Table 3 lists the results of total dead time (bottleneck) of pick up machine and truck, total operating time and cost of the biomass supply chain, regarding specific scenarios (1-34, 1-48, 1-62, etc) in a field of 5 ha and travel distance between field and bio-energy plant of 15 km. The first number of the combination (1, 2) represents the number of trucks used in the process. The second number (34, 48, or 62) refers to the capacity (bales) of the truck. Fig. 4 shows graphically the total dead time of pick up machine and truck during the process for each combination.

Dead time is a stage in a process that causes a part of the process or the whole process to slow down or stop. The dead time of pick up machine is created when there is no available truck and the pick up machine waits for being unloaded. The dead time

of the truck is created when the pick up machine collects bales from the field and the truck waits for being loaded.

Table 3. Dead Time, Total Operational Time and Total Cost

No Trucks-Capacity	Dead Time PU (min)	Dead Time Truck (min)	Total Time (min)	Total Cost (€)
1-34	153	139	964	1085
1-48	116	139	930	1060
1-62	130	139	930	1063
2-34	0	169	811	1074
2-48	0	173	814	1066
2-62	0	180	817	1067

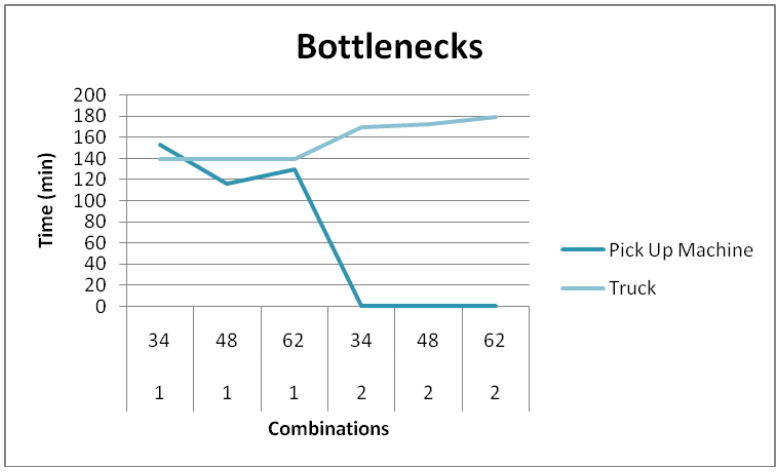


Fig. 4. Total dead time of Pick Up Machine and Truck by changing the number and/ or the capacity of the truck

5 Discussion

Fig. 3(a) shows that more time is consumed for biomass supply chain when one truck is used instead of two. This difference is greater in long distances (25 km) than in short distances (5 km). For stable travel distances, the increase of capacity after a certain point does not reduce the total operating time because even if the number of transportations is less, the loading and unloading time is increased. A solution could be more forklifts in use in both locations (field and bio-energy plant). Also, the capacity and/ or the number of pick up machines could affect the total operating time. It should be noticed that when two trucks of low capacity (34 bales) are used, less time is needed than in the case of one truck of high capacity (62 bales) for same travel distances. The period of absence of a low capacity truck is less than a high capacity

truck, while at the same period the second truck continues the operation making the entire process faster.

As it is shown in Fig. 3(b), the total cost is higher in long distances (25 km) than short distances (5 km) for both cases. The biomass supply chain costs less in short distances when one truck is used and in long distances when two trucks are used. The cost is reduced when the capacity is increased, but when the capacity overcomes the optimal, then the cost is not reduced anymore (e.g. 62 bales capacity).

As it is presented in Table 3 and Fig. 4, in the case of one truck in use, the dead time of pick up machine is reduced as the capacity of the truck is increased from 34 bales to 48 bales. Although, when the capacity is increased to 64 bales the dead time is greater than the case of 48 bales capacity, because the truck of 64 bales capacity needs more time to be unloaded when it arrives to bio-energy generation plant delaying the activity of pick up machine. This implies that truck with high capacity does not always minimise the bottlenecks of an activity due to the interaction that capacity has to other parameters, such as unloading time.

By using two trucks in the process, the dead time of pick up machine reaches zero because there is always an available truck. However, the dead time of the truck is getting higher in comparison with the case of one truck because the second truck is always waiting for the first to be loaded and leave. As the capacity of the trucks becomes higher, the dead time of the trucks is increased because the second truck waits longer. For minimizing the dead time of a truck, increased number and/ or capacity of pick up machines should be used. Also, the total number of forklifts in use should be considered in both locations (field and bio-energy plant) in order the bottlenecks of the truck to be reduced.

By analysing Table 3, it occurs that higher dead time of a machine does not necessarily mean higher total operating time or cost. For long travel distances between the field and the bio-energy plant, when low capacity trucks are used, the process is more expensive because of the increased number of transportations.

6 Conclusion

A simulation model for biomass supply chain including the operations of mowing, baling, picking up, loading, transporting and unloading was created. Different scenarios concerning how the number and/or the capacity of the truck(s) can affect the process in terms of time, cost and bottlenecks were examined. The increased number and/or capacity of trucks make the process less time consuming but not always less cost consuming. Factors like the area of the field and travel distance should be considered for the best choice of number and capacity of the truck. However, the biomass supply chain can be more optimized in terms of time, cost and bottlenecks, if the number and capacity of pick up machine as well as the number of forklifts are taken into consideration.

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Assessing the Success of an Information System: the Case of Audits for O.P.E.K.E.P.E.

Nikolaos A. Galanis[1], Prodromos D. Chatzoglou[2]

[1]Payment and Control Agency for Guidance and Guarantee Community Aid, Greece, e-mail: nikolaos.galanis@opekepe.gr
[2]Production and Management Engineering Department, Democritus University of Thrace, Xanthi, Greece, e-mail: pchatzog@pme.duth.gr

Abstract. Considering previous theoretical models and empirical studies, this study's goal is to develop a tool for assessing the success of a web-based Information System and to evaluate it experimentally. This is Audits, a system used by a non-profitable public organization, O.P.E.K.E.P.E. Success is evaluated based on system's effects on the employees and the organization, as well as the satisfaction of the end users. At the same time, this study explores the factors that facilitate or undermine the success of an IS according to data gathered from the technology acceptance related literature. The proposed model has been tested using primary data from a sample of 192 regular users of the specific system, who actually represent almost two fifths of its total active users. The empirical results only partly verify the relationships examined and contribute in the design of a valid and reliable conceptual model.

Keywords: Success of an Information System, O.P.E.K.E.P.E., Satisfaction of the user, Effects of Information Systems, E-government in Agriculture

1 Introduction

This study attempts to address the issue of developing and theoretically substantiating a model that assesses the success of a particular IS used by a Hellenic organization, the Payment and Control Agency for Guidance and Guarantee Community Aid (O.P.E.K.E.P.E.). The explored model is a creative research composition of recognized theoretical models and as such, there is no precedent of a study having the same structure. Its originality consists of the combination of factors incorporated from models that study the acceptance and use of technology and those that constitute the multi-dimensional concept of the success of IS. Moreover, this study and the proposed theoretical framework allows for the evaluation of the success of the specific IS.

Payment and Control Agency for Guidance and Guarantee Community Aid (O.P.E.K.E.P.E.) is a legal entity governed by private law under the control of the European Commission and the European Court of Auditors. Its scope is to pay in time, properly and in a transparent manner the agricultural aid granted by the

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European Union for the agricultural sector and amounts approximately to 4 billion Euros annually. O.P.E.K.E.P.E. performs administrative and on-site controls on random or on the entirety of the applications submitted by the potential beneficiaries before depositing the money in their bank accounts. The IS called "Audits" is a system having as its principal objective to administer, coordinate and supervise the audits of the organization that are the core of its functions. "Audits" facilitates the operating automation which results in saving valuable working hours, along with the support of decision making by the members and the administration of O.P.E.K.E.P.E.

2 Literature Review

Kim et al. (2003) consider IS success as the extent of the improvement of the stakeholders' position according to the person assessing the IS. Au et al. (2002) state that it would be ideal to assess the effectiveness of an IS based on objective criteria, for example cost-profit analysis. To the contrary, this approach is criticized since it is difficult to determine whether certain profits result entirely from using the IS.

Due to the multi-dimensional nature of the IS success, the first attempts to study it as a one-dimensional success were inadequate. DeLone and McLean (1992) reviewed in depth previous theoretical and empirical studies and developed in an assessment model (D&M) that recognizes six factors that constitute the IS success. Seddon (1997) claimed that the original D&M model was confusing as far as the use of IS factor is concerned and, therefore, suggested splitting it in two parts. One part was about the IS success and the other about the IS use, which he defined as an opinion and behavior rather than a way to assess the IS success.

DeLone and McLean (2003) revised their initial model by adding the quality of services dimension, while removing the two dimensions concerning the effects of IS on the users and the organization and replacing them by a wider dimension (net profits from using the IS). Since this dimension is rather vague, considering the specific system it can comprise several groups of interested parties and, thus, be more flexible. Further, they have also added the concept of intention to use that might replace the actual use, where appropriate, when use of the IS is obligatory. Following a similar philosophy, Gable et al. (2008) attempted to redefine the notion of IS success as a multi-dimensional set of factors. Their model known as IS-Impact, suggests that the future IS impact which is related to the expectations arises from the quality of the system and the information.

Moreover, Wixom and Todd (2005) claim that IS success shall be assessed based on two principal stands of research. The one has to do with users' satisfaction and the other with users' acceptance of technology. However, although these two approaches have been studied in parallel, not even a single attempt to correlate them is reported in the literature.

As far as the users' acceptance of technology is concerned, several theoretical models have been developed based mainly, in addition to information technology factors, on the sciences of psychology and sociology (Venkatesh et al. 2003). A common example is the Thompson et al. (1991) Model of PC Utilization (MPCU)

that calculates the extent of an IS use based on six factors: compatibility, complexity, long-term effects, emotions, social factors and facilitation conditions.

Doll and Torkzadeh (1988) contributed in the field of user's satisfaction by developing the EUCS (End User Computing Satisfaction) that approaches satisfaction through five factors: content, accuracy, form, ease of use and timeliness. Needless to say, these dimensions overlap with factors that are considered for the assessment of other dimensions of the IS success.

The review of several previous empirical studies concluded that there is not a clear and restrictive framework regarding the conceptual definition of each variable concerning IS success. On the contrary, several of the variables, and the way most scholars tend to approach them, appear to overlap, making it difficult to compare the results of different studies. It is worth mentioning that based on the statistics provided by Gable et al. (2008), the review of sixteen studies that focus on the dimension of the user's satisfaction has shown that it has been assessed by reference to data that overlap at a rate of 98% with data that have been used in other studies to assess other dimensions of the IS success.

Table 1. Synopsis of selected empirical studies.

Authors	**Short description**	**Study effects**	**Support**
Cheung & Lee (2008)	Satisfaction from web-based IS	Information Quality →Satisfaction	Yes
		System Quality → Satisfaction	Yes
Gorla *et al.* (2010)	Effect of IS quality on IS success in terms of organizational impact	Information Quality →Organizational Impact	Yes
		System Quality → Organizational Impact	Yes
		Service Quality →Organizational Impact	Yes
Floropoulos *et al.* (2010)	Assessment of success of the greek taxation IS	Information Quality→Usefulness	Yes
		Service Quality → Usefulness & Satisfaction	Yes
		Usefulness → Satisfaction	Yes
Al-adaileh (2009)	IS success model on the user's side	Information Quality →Success Perception	Yes
		Usefulness → Success Perception	No
		Ease of Use → Success Perception	Yes
		Management Support → Success Perception	Yes
Halawi *et al.* (2007)	Empirical study of the success of a knowledge management IS	System Quality → Use	Yes
		System Quality → Satisfaction	Yes
		Information Quality → Use	Yes
		Information Quality → Satisfaction	Yes
		Service Quality → Use	No
		Service Quality → Satisfaction	Yes
		Satisfaction → Individual Impact	Yes
Iivari (2005)	Empirical evaluation of the D&M model	Use →Satisfaction	Yes
		Satisfaction →Use	Yes
		Satisfaction → Individual Impact	Yes
Wixom&Watson (2001)	Empirical research of a storage data IS	System Quality → Organizational Impact	Yes
		Information Quality → Organizational Impact	Yes
Negash *et al.* (2003)	Quality and Effectiveness of web-based IS	System Quality → Satisfaction	Yes
		Information Quality → Satisfaction	Yes
		Service Quality → Satisfaction	No
Byrd *et al.* (2006)	IS effect on organizational costs	System Quality → Individual Impact	No
		Information Quality → Individual Impact	No
		Individual Impact → Organizational Impact	Yes

3 Conceptual Framework

3.1 The Research Model

This study suggests a model for assessing the IS success which is based on previous success models, models for the assessment of the user's satisfaction as well as technology acceptance models. To some extent the proposed model is based on the classification of the DeLone and McLean D&M model (1992), as amended by them (2003) and, at the same time, it evaluates the intermediary factors that facilitate, or undermine the IS success.

In particular, the proposed model adopts all three quality dimensions of the D&M, i.e. system quality, information quality and service quality, which can be broadly viewed as the set of characteristics of the IS and its services. In the authors' view, these characteristics do not constitute clear standards of the IS success, given that technical appropriateness, informative sufficiency and high-level service quality are not "sine qua non" conditions for the IS success since, according to Doll and Torkzadeh (1988), reduced users' satisfaction can turn a technically robust system into a failure.

Moreover, from the Thompson's et al. (1991) MPCU model, the dimension of top management support, as well as the complexity of the IS as seen by the users, have been utilized in the proposed model. From the Moore and Benbasat's (1996) model the dimension of the IS compatibility to the characteristics of the users and their already existing habits has been adopted. Further, the dimension of the perceived behavioral control on behalf of the user has been adopted from the Taylor and Todd study (1991). All the above mentioned dimensions are integrated in the proposed model while examining their connection to the satisfaction of the users along with the IS impact on the employees.

Finally, the impact on the employees and the organization, as well as users' satisfaction, as integrated in the initial D&M model, are studied and adopted as the success dimensions of the IS. In comparison to the previously mentioned theoretical models, there has been no consideration of the dimensions regarding the actual use or the intention to use the IS. As for users' satisfaction, the emphasis in this research is on its psychological aspects that relate significantly to the pre-existing attitudes and emotions of the user towards the IS. By choosing this approach and documenting it adequately, it is ensured that any possible overlapping of the data with the examined dimensions will be avoided.

3.2 Information System Characteristics

Focusing on the characteristics of IS (information quality, system quality, service quality), Gable et al. (2008) claim that system quality depends on the IS efficiency, both on a technical and designing level. The most detailed approach of the system quality concept was performed by Sedera and Gable (2004), who acknowledge the

following variables in respect of quality: ease of use, ease of learning, users' requirements, system accuracy, flexibility, intelligence and adaptability. Urbach and Müller (2012) define information quality as the desired information characteristics produced by the IS. Byrd et al. (2006) consider as quality standards the timeliness, accuracy, reliability, relevance and completeness of the information. Furthermore, according to Grüter et al. (2010), the concept of service quality embraces all services provided to the users. Moreover, it embraces the services that are provided indirectly through the provision of customized content in real time for the user.

3.3 Regulating Factors

Top management's support is set out to be the intervention and participation of the executive and strategic members of the organization in the functions that relate to the IS (Jarvenpaa and Ives, 1991). Further, Moore and Benbasat (1996) understand the concept of work compatibility as the extent to which the current recipients understand the system's innovations as consistent with their existing principles, values, needs and experiences. Moreover, by implementing the concept of perceived behavioral control, Taylor and Todd (1991) refer to users' perceptions regarding the external and internal obstacles in accepting and using technology that relate to the available resources and the existing technological background.

Finally, within the scope of the Thompson's et al. (1991) MPCU model, complexity is associated with the extent to which users think that it is difficult to understand or use the system. Lin and Shao (2000) acknowledge that complexity affects greatly users' participation which, in turn, impacts system's use positively.

3.4 Success Factors of the Information System

A third group of factors that are examined within the current study, concerns the IS success factors of the IS. More specifically, end user satisfaction, individual and organizational impact. Doll and Torkzadeh (1988) define end user satisfaction as the positive attitude of a person towards a specific technological application when directly interacting with it. In several cases, scholars tend to integrate in this dimension factors which constitute a different dimension of the IS success in other models (e.g. Ong et al. 2009). As a result, since this study also examines information quality and system quality as separate dimensions of the IS success, the authors choose a different approach for measuring end user's satisfaction. It is defined as the overall satisfaction of a user as perceived by him based on his psychological and emotional notions and stands towards the system as a whole. The approach is consistent not only to the Au's et al. (2002) proposal, which determines satisfaction as the extent of the total positive assessment and the degree of pleasure that arises from the use of the IS but, also, to the Wang's (2008) study where it is claimed that users' satisfaction must be measured in a direct way in order to determine the total degree of satisfaction, and not indirectly through other factors. Mckinney et al. (2002) hold the same opinion and state that user's satisfaction reflects on how pleased, satisfied, excited and positively disposed he is regarding the system's use.

The term “impact on employees” is a paraphrase of the original term “impact on people” in the D&M model (DeLone and McLean, 1992). Gable et al. (2008) claim that the IS impact on people is related to the way it affects their personal capabilities and their productivity. Hou (2012) includes also the decision making dimension in the dimension of personal performance.

Finally, Gable et al. (2008) argue that the impact of IS on the organization is related to the extent that the IS has improved the performance of the organization, as well as its potentials. They acknowledge three factors which are process improvement, increase of potentials and cost reduction. Sedera and Gable (2004) analysis is similar, although in addition to the above mentioned factors, they study the improvement in productivity as a dimension of the organizational impacts factor.

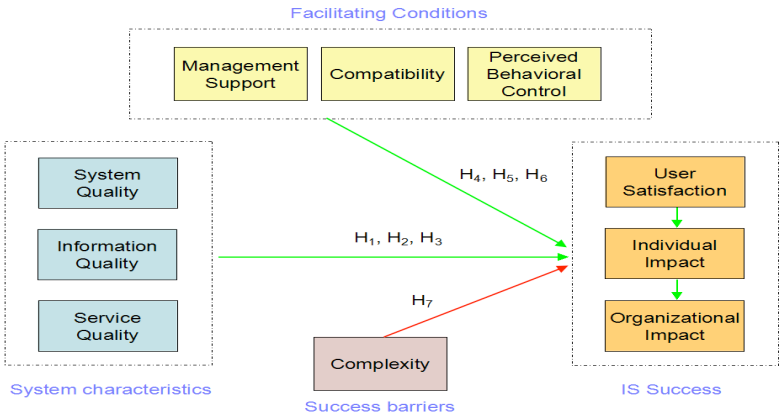

Fig. 1. The research model.

4 Research Methodology

The study population consists of users of the specific IS who have logged in and used it during the most recent auditing period for the organization (475 persons). For gathering the necessary data, the survey method was chosen and a structured questionnaire (mainly with closed type questions) was used for the collection of the data. The questionnaire consists of ten sections, one for each major factor that is included in the research model. Every section consists of subsections, one for each dimension, while for each separate dimension there is a set of relevant questions (Table 2). Furthermore, several demographic factors were recorded. Apart from the questions concerning the demographic characteristics, the Likert five point rating scale is adopted for answering each question.

In line with previous studies and the assessment of the standards used for the evaluation of the system quality, for the scope of this study questions measuring five dimensions (usability, sophistication, system reliability, accessibility and

documentation) have been used. Similarly, information quality is evaluated using questions measuring five dimensions (understandability, completeness, usefulness, timeliness and reliability). Additionally, for the assessment of service quality, the selected variables can be arranged in three dimensions (assurance, responsiveness and empathy); these variables are included in the Parasuranam et al. (1988) SERVQUAL and are similar to the ones also used by Ong et al. (2009) and Gorla et al. (2010). Top management support, perceived control, complexity, compatibility and satisfaction have been measured using one dimension for each one of them.

Table 2. Variables' sources.

Factor	Items	Sources
C1. Usability	7	Gable *et al.*(2008), Cheung & Lee (2012), Grüter *et al.* (2010), Gorla *et al.* (2010), Sedera & Gable (2004), Zheng *et al.* (2013), Elling *et al.* (2012)
C2. Sophistication	3	Gable *et al.* (2008), Gorla *et al.* (2010)
C3. Relability	4	Gable *et al.*(2008), Grüter *et al.*(2010)
C4. Accessibility	4	Cheung & Lee (2012), Grüter *et al.* (2010), Gable *et al.* (2008), Byrd *et al*. (2006), Negash *et al.* (2003)
C5. Documentation	3	Hasan & Abuelrub (2011), Gorla *et al.* (2010)
D1. Understandability	3	Gable *et al.* (2008), Cheung και Lee (2012)
D2. Completeness	3	Grüter *et al.* (2010), Byrd *et al*. (2006)
D3. Usefulness	5	Cheung και Lee (2012), Gable *et al.* (2008), Byrd *et al*. (2006), Ong *et al.* (2009)
D4. Timeliness	3	Byrd *et al*. (2006), Negash *et al.* (2003), Hasan & Abuelrub (2011)
D5. Relability	3	Byrd *et al*. (2006), Cheung & Lee (2012), Negash *et al.* (2003), Grüter *et al.* (2010), Gable *et al.* (2008)
B1. Assurance	4	Grüter *et al.* (2010), Gorla *et al.* (2010)
B2. Responsiveness	3	Ong *et al.* (2009), Gorla *et al.* (2010)
B3. Empathy	3	Gorla *et al.* (2010)
E1. Management support	3	Thompson *et al.* (1991)
E2. Compatibilty	3	Moore & Benbasat (1996)
E3. Behavioral Control	3	Taylor & Todd (1991)
E4. Complexity	3	Thompson *et al.* (1991)
G1. User satisfaction	10	Xiao & Dasgupta (2002), Ong *et al.* (2009), Grüter *et al.* (2010), Sun & Teng (2012), Wang (2008)
H.1 Job usefulness	9	Gable *et al.* (2008), Hou (2012), Ong *et al.* (2009), Wu & Wang (2006), Eom (2013), Sun & Teng (2012)
H2. Decision effectiveness	4	Hou (2012)
H3. Personal valuation of IS	4	Wang (2008)
I1. Organizational performance	4	Byrd *et al*. (2006), Gable *et al.* (2008)
I2. Business Process Change	3	Gable *et al.* (2008)
I3. Management Control	3	Torkzadeh & Doll (1999), Byrd *et al*. (2006)
I4. Services Enhancement	3	Gorla *et al.* (2010)

For the evaluation of individual impact, the variables chosen can be classified in three dimensions (job usefulness, decision effectiveness and personal valuation of IS), while the variables to assess organizational impact can be arranged in four dimensions (organizational performance, business process change, management control and service enhancement). The questionnaire was distributed to three active users of the specific IS, in order to pilot test it and identify any possible ambiguity or problematic issues. The finalized questionnaire was uploaded on Google via Google Forms and was made available for purely anonymous responses. The link has been published at the specific IS home page. Moreover, a personal email was sent to every user of the IS that has a registered email address. It is considered that 359 users were directly informed about the existence of the questionnaire, while 192 of them have completed it (response rate of 54%). In comparison to the population, as previously defined, the response rate is 40%.

5 Study Results

From the 192 IS users who participated in this study 122 were women and 70 men. Most of them (80%) belong to the 25 and 44 years old age group and are highly educated (55% has a university degree and 35% has a post graduate degree). Almost half of the participants (45%) are agronomists, while the remaining users are of various specialties. The vast majority (77%) of the users position themselves as highly familiar with computer technology. It can be easily conclude from an overall view of the answers provided to the questions regarding users' opinion of the IS, the participants have a positive attitude towards it. For the element "I have positive feelings for Audits" the average rate of the responses was 4,88 with 113 of the 192 users chosing scale 5, an indication that shows their positive attitude towards the specific IS and constitutes the higher average rate for a separate question in the study.

5.1 Factor Analysis

For the factors and sub-factors of the model, the Kaiser-Meyer-Olkin (KMO), Total Variance Explained (TVE) and Cronbach a indicators were assessed along with the loading values of each variable for every factor. According to Walker and Maddan (2009), KMO values greater than 0,6 show data suitable for factor analysis. For the Cronbach α indicator, most scholars tend to use the value of 0.7 as a threshold, which is supported by Nunnally's suggestions (1978, p.278), who assumes that on basic research level, the value of 0.7 is acceptable. Furthermore, Hair et al. (1992) set the value of 0.5 as the minimal acceptable value for the factor loadings of each variable.

The conclusion that emerges from the values of the indicators is that they are within the acceptable limits in all cases and without exceptions. Based on the above mentioned data, it is presumed that the factors examined within the scope of the conceptual model of this study can be assessed with significant reliability based on the data extracted from the participants.

5.2 Correlation Analysis

Table 5 demonstrates that the factors of the model are greatly correlated. The only statistically non significant relation is the one between factors E1: Top Management Support and F: Complexity. By focusing exclusively on the correlations between the dimensions of quality and regulating conditions and the factors of success, it is observed that the factor of complexity (F) is less correlated to the three factors of the IS success. Among the rest, the correlations between the E1 factor (management support) and E3 (perceived control) are relatively low, while the highest correlations to the success factors are those of the three quality dimensions and the compatibility factor. The table includes, for illustration purposes only, the variable ISS (Information Systems Success) which has been calculated as the mean of the three success factors (G, H and I).

Table 3. Factor analysis and reliability testing of dimensions.

Factors	Dimen-sions	Ques-tions	Mean	St.D	KMO	TVE	Factor Loadings	Cron-bach a
B: Service Quality	B.1	1-4	4,37	.627	.793	61.903	.775 - .800	.788
	B.2	1-3	4,50	.609	.720	76.310	.858 - .896	.841
	B.3	1-3	4,39	.660	.699	78.137	.833 - .920	.858
C: System Quality	C.1	1-7	4,53	.590	.856	67.658	.710 - .876	.911
	C.2	1-3	4,40	.579	.719	73.972	.849 - .871	.824
	C.3	1-4	4,34	.682	.702	68.450	.778 - .860	.844
	C.4	1-4	4,49	.644	.764	73.481	.833 - .883	.878
D: Information Quality	D.1	1-3	4,58	.602	.746	85.900	.905 - .943	.917
	D.2	1-3	4,31	.637	.739	82.498	.893 - .928	.894
	D.3	1-3, 5	4,49	.591	.784	72.308	.745 - .889	.860
	D.4	1-3	4,27	.683	.731	80.232	.870 - .914	.876
	D.5	1-3	4,41	.679	.693	84.032	.861 - .954	.904
E: Facilitating Conditions	E.1	1-3	4,27	.741	.658	72.642	.802 - .909	.806
	E.2	1-3	4,32	.743	.724	86.005	.886 - .951	.914
	E.3	1-3	4,62	.525	.665	72.500	.776 - .902	.800
F: Complexity	F.1	1-3	3,45	1.558	.662	72.798	.793 - .907	.786
G: Satisfaction	G.1	2-9	4,40	.624	.925	72.776	.766 - .888	.944
H: Individual Impact	H.1	2-4, 6-9	4,23	.756	.936	74.767	.815 - .906	.950
	H.2	1-4	3,94	.914	.823	85.411	.873 - .939	.943
	H.3	1-4	4,53	.590	.767	73.278	.827 - .887	.877
I: Organizational Impact	I.1	1-4	4,45	.703	.806	77.787	.796 - .927	.902
	I.2	1-3	4,30	.701	.703	79.748	.847 - .901	.872
	I.3	1-3	4,26	.778	.720	81.430	.864 - .930	.881
	I.4	1-3	4,08	.944	.701	86.788	.884 - .946	.924

Table 4. Factor analysis and reliability testing of factors

Factors	KMO	TVE	Factor Loadings	Cronbach alpha
B	.755	86.908	.916 - .937	.924
C	.785	74.307	.836 - .911	.883
D	.861	76.884	.802 - .920	.920
E	.607	63.236	.657 - .842	.709
F	.662	72.798	.793 - .907	.786
G	.925	72.776	.766 - .888	.944
H	.698	82.566	.864 - .946	.882
I	.813	74.331	.814 - .918	.874

Table 5. Results of Spearman analysis

	B	C	D	E1	E2	E3	F	G	H
B: Service Quality	1 -								
C: System Quality	,733 ,000	1 -							
D: Information Quality	,782 ,000	,845 ,000	1 -						
E1: Management Support	,421 ,000	,482 ,000	,544 ,000	1 -					
E2: Compatibility	,571 ,000	,640 ,000	,698 ,000	,545 ,000	1 -				
E3: Perceived control	,391 ,000	,515 ,000	,474 ,000	,360 ,000	,443 ,000	1 -			
F: Complexity	,206 ,004	,270 ,000	,194 ,007	,117 ,108	,229 ,001	,219 ,002	1 -		
G: User satisfaction	,626 ,000	,782 ,000	,768 ,000	,460 ,000	,734 ,000	,457 ,000	,263 ,000	1 -	
H: Individual Impact	,560 ,000	,636 ,000	,666 ,000	,461 ,000	,704 ,000	,346 ,000	,187 ,009	,767 ,000	1 -
I: Organizational Impact	,575 ,000	,577 ,000	,636 ,000	,452 ,000	,668 ,000	,340 ,000	,276 ,000	,701 ,000	,816 ,000
ISS: IS Success	,639 ,000	,716 ,000	,745 ,000	,499 ,000	,766 ,000	,409 ,000	,264 ,000	,882 ,000	,943 ,000

5.3 Analysis based on the Structural Equation Modeling Method (SEM)

In order to test and verify the model, the SEM method has been used so as to examine whether the model can interpret the data sufficiently. The assessed relations are those between all the IS quality factors and the regulating conditions and the IS success factors along with the internal relations among the separate dimensions of the major factors, i.e. the system characteristics and the facilitating conditions. The results of this analysis are shown in figure 2.

To assess the model validity, a set of indicators has been calculated: CMIN/DF, GFI, CFI, NFI, RMR and RMSEA (Table 6). The values (of model 1) do not fall within the acceptable limits, although marginally in most cases, therefore it is necessary to further process the model. However, the data are appropriate for testing the individual relations, as they record the correlations with statistical significance.

The covariance analysis shows statistically significant relations among the errors of the independent variables of the model (shown in Figure 2 as well). These relations were expected as these factors constitute hyper-factors. One hyper-factor concerns the characteristics of the system, incorporating the three quality dimensions of the revised D&M model, and the other group the three facilitation conditions that were used. The factors of the model that concern IS success remain separate. The results of the new analysis are shown in figure 3.

The same indicators are calculated for the SEM analysis on the amended model. The values of the indicators are excellent based on what was previously mentioned and, therefore, this amended model can interpret very well the data extracted from the study (user satisfaction 69%, individual impact 65%, organizational impact 74%).

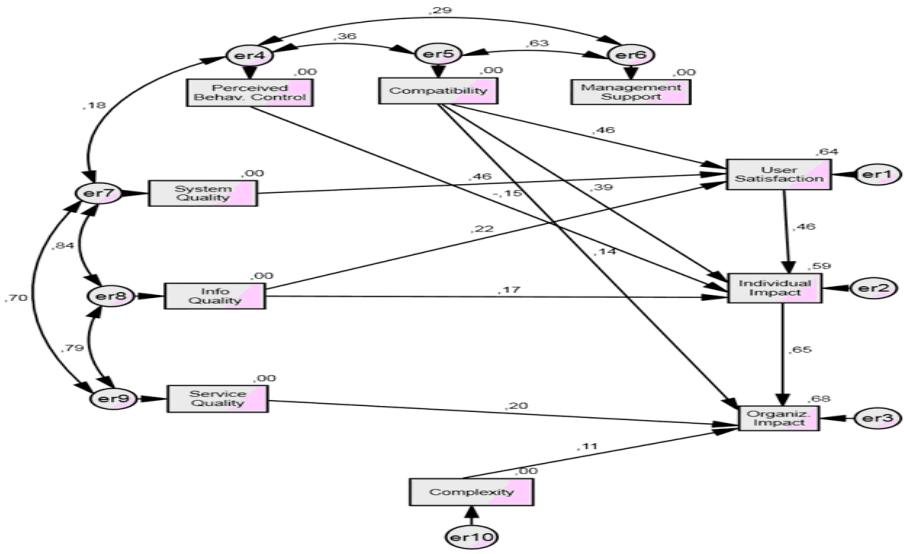

Fig. 2. SEM analysis on the initial model (model 1).

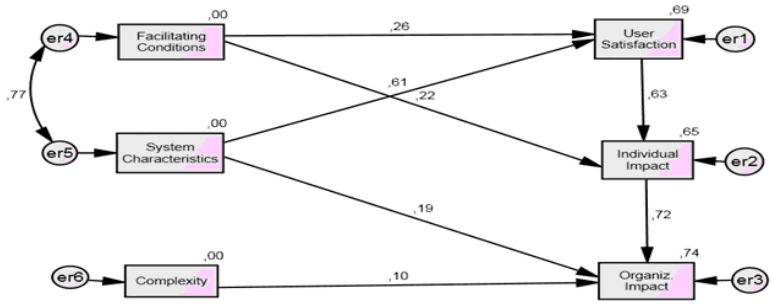

Fig. 3. The amended model (model 2).

Table 6. SEM analysis indicators – Initial model

	CMIN/DF	GFI	CFI	NFI	RMR	RMSEA
Model 1	8.089	0.864	0.877	0.865	0.136	0.193
Model 2	1.681	0.980	0.994	0,986	0.083	0.06
Accepted Values	<2	>0.9	>0.9	>0.95	<0.1	≤0.07
	Byrne (1989)	Baumgartner and Hombur (1996)	Hu and Bentler (1999)	Hu and Bentler (1999)	Hair *et al*. (1992)	Hu and Bentler (1999)

The original hypotheses finally supported from the results of the statistical analysis are the following nine (out of twenty): H1a (System Quality - User satisfaction), H2a (Information Quality - User satisfaction), H2b (Information Quality - Individual Impact), H3c (Service Quality - Organizational Impact), H5a (Compatibility - User satisfaction), H5b (Compatibility - Individual Impact), H5c (Compatibility - Organizational Impact), H8 (User satisfaction - Individual Impact) and H9 (Individual Impact - Organizational Impact).

6 Conclusions

To begin with, given that answers to all questions have a high average rate (Table 3), it can be easily assumed that "Audits" is a successful IS and, in any case, its users have a very positive attitude towards the issues that they were asked to assess.

It has been concluded (Fig. 3) that the two most common IS quality dimensions, i.e. system quality and information quality, with the first being more powerful, have a positive effect on users' satisfaction (.46 and .22 respectively). It seems that users rate technical capabilities of the IS as more important compared to the quality of information. On the contrary, the third dimension, service quality, has no effect on users' satisfaction. This conclusion can be assigned to the perceived high quality of the specific IS, as well as to the high level of users' familiarization to technology.

As for the effects on the employees, it seems that only information quality affects them positively (.17) in a direct manner. Moreover, no evidence supporting the positive relation between the system and information quality and the organizational impact is found. However, a slightly positive (.20) direct relation between service quality and impact on the organization can be noticed. As far as the facilitation conditions are concerned, IS compatibility plays a powerful role and has a positive impact on all three success dimensions; the most powerful is the contribution to users' satisfaction (.46), followed by the effect / impact to the individuals (.39) and to the organization (.14). On the contrary, there is a very little, but statistically significant, effect of the complexity only to organizational impact (.11). Similarly, the effect of top management support to users' satisfaction is not supported by the results of this study, which can be explained by the obligatory nature of the IS, which therefore reduce the importance of the role of managers when the specific IS is used. This study however, has verified to the greater extent that satisfaction affects the impact on individuals (.46) and, in turn, it affects organizational impact (.65).

Based on the amended model (Figure 3), it appears that the IS characteristics, in the way these have been defined in the current study, have a strong positive direct impact on users' satisfaction (.61), while the relation with organizational impact is much weaker (.19). The selected facilitating conditions have similar positive affect on satisfaction (.26) and individual impact (.22). Moreover, a positive sequence of effects is observed within the group of success dimensions. Specifically, user satisfaction influences individual impact in a positive manner (.63) and, in turn, individual has a positive effect on organizational impact (.72).

The approach to combine IS success theories together with Technology Acceptance models is proven rather successful, especially with regard to the factor of complexity based on the value of the relations that were documented empirically.

6.1 Implications and Practical Impact

At actual conditions, this study could be of use to organizations in order to assess internally the IS they use, or the effective selection of a new one focusing to the desired requirements that would result in organizational benefits. As far as the organization of the specific IS, it must emphasize on the development of technically robust systems that will operate without hindrance and any operational difficulties, since it seems that these are the characteristics that affect strongly the success of an IS. Furthermore, it is necessary to ensure that all IS provide to users information useful to their work. Last, but not least, it is evident that the adoption of an IS, in order to process and support the work of the employees and the organization, must be carefully selected and be designed based on the compatibility of the new system to the existing routine and habits of the employees, given that, pursuant to the conclusion of this study, this is the factor that affects all the IS success factors.

6.2 Limitations – Suggestions

It is possible that some aspects of the IS are assessed by users in such manner that renders the verification of the proposed model rather difficult or less reliable, probably because of the "halo effect" (Thorndike, 1920). To that aim, it would be more efficient to assess this model using another IS, in order to extract more useful and reliable conclusions about its validity.

This study does not consider the possible effect of the personal and organizational impact on the factor of the users' satisfaction. Hence, it would be interesting to study the implication of the possible regenerating nature of the relation between the satisfaction and the impact on the people and the organizations. Moreover, the fact that the use of the IS is compulsory sets another restriction and hinders the generalization of the conclusions. Furthermore, the study of the IS success was focused on users, although, according to Seddon et al. (1999), success concerns other parties as well and, as a result, it would be useful to study this aspect in the future.

Lastly, this study emphasizes on the attitudes and perceptions of the IS users and not on objective assessment standards. To that direction, it would be useful to cross check the results by real data relating to the productivity of the employees along with the performance of the organization regarding the cost of the executed audits.

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Soil Parameters Assessment by Remote Sensing

Theofanis A. Gemtos[1], Christos Cavalaris[2], Christos Caramoutis[2], Dimitris Anagnostopoulos[2], Stavros Giouvanidis[2], Spyros Fountas[2]

[1]Laboratory of Farm Mechanisation, University of Thessaly, Fytoko Street, N. Ionia, 38446 Mangesia, Greece, +30.2421093228, gemtos@agr.uth.gr
[2]Laboratory of Farm Mechanisation, University of Thessaly, Fytoko Street, N. Ionia, 38446 Mangesia, Greece

Abstract. In this paper, remote sensing measurements like apparent electrical conductivity (ECa.) are used to assess soil compaction. In an experiment comparing five tillage treatments and their effect to energy crops soil penetration resistance (SPR) was measured at the same time as ECa. ECa measurements were carried out using EM-38with dipoles at 1m apart and SPR by an electronic penetrometer. The negative correlation between the two parameters for all measurements resulted in R2= 0.73. Taking the measurements for each treatment in conventional tillage plots R2 = 0.53, chisel plough tillage 0.61, rotary tiller 0.69, disk harrow 0.55, strip-till 0.35 and no till 0.81.

Keywords: soil compaction, tillage, soil apparent electrical conductivity, soil penetration resistance

1 Introduction

Soil compaction is a major problem of soil degradation affecting soil fertility and crop yields. Soil compaction is caused in the present day agriculture mainly by heavy farm machinery. Several factors affect compaction by machinery like soil water content, machinery weight, machinery tyres (width, type and inflation pressure). Compaction is not homogeneous in all parts of the field because it depends on the traffic of each part. The compaction caused is alleviated by soil tillage. Soil deep loosening causes breaking of the soil causing the restoration of large pores and facilitates the soil functioning. Tillage practices employing deep loosening and soil inversion like conventional tillage using ploughing or minimum tillage that causes soil loosening at different depths without soil inversion can lead to higher or lower soil disturbance and loosening. Soil tillage is an energy and labour consuming practice and the intensity depends on the soil compaction. It would be of interest to find ways to assess soil compaction in order to apply variable rate tillage depth and reduce energy consumption.

Soil compaction is measured by instruments like penetrometers measuring soil penetration resistance (SPR) at different depths, by measuring dry bulk density at layers of different depths and by measuring water infiltration rate. Penetrometers are

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usually following the ASABE standardisation (ASABE 2014). The penetrometer has a cone with base diameter of 12.83 mm and cone angle of 30º. It is inserted at stable speed up to a depth usually of 50 cm. Undisturbed soil cores are taken at different depths and the dry weight of the unit of volume is estimated. Water infiltration is measured by metallic tubes filled with water and the rate of water infiltrated by the soil is measured. All methods are time and labour consuming and are difficult to be applied. An alternative method proposed in the literature to estimate soil compaction is the measurement of soil apparent electrical conductivity (ECa). This is a method that can measure soil properties on the go. This is a fast and low cost method. The sensors are based on electrical and electromagnetic, measurements (Adumchuk et al.2004). Electrical resistivity and electromagnetic induction (EM) was used to assess the soil apparent electrical conductivity (ECa). The ECa measures conductance through not only the soil solution, but also through the solid soil particles and via exchangeable cations that exist at the solid–liquid interface of clay minerals.(Colvin and Lesch 2003). This property is directly connected to soil properties like texture, water content, organic matter, salinity, ions in the soil and temperature. There are formulae to correct measurements to a basis of 25º C (Ma et al. 2011). If we exclude saline soils from the measurements and take measurements near field capacity most measured conductivity is due to soil texture. Electric resistivity instruments use flat, vertical disks to apply a voltage and measure the soil resistance by measuring the current in other similar disks (Figure 1). The distance between the disks defines the depth of the measurement. In Electromagnetic induction sensors (Figure 2) coils induce and measure the electricity. An EM transmitter coil located at one end of the instrument induces circular eddy-current loops in the soil. The magnitude of these loops is directly proportional to the ECa of the soil in the vicinity of that loop. A second coil measures the produced current which is the result of soil properties (e.g., clay content, water content, organic matter, ions). Instrument construction (distance between the dipoles), orientation and distance from the soil when measurements are taken define the depth the soil the measurements present.

Fig. 1. Electrical resistivity instrument (VERIS)

Fig. 2. Electromagnetic induction (EM) instrument.

The two instruments were used in many applications in precision agriculture combined with GPS. They provide a fast and relatively cheap way to produce maps which are presenting the variability of the field and they are correlated to yield. Many researchers have reported this connection (Kitchen et al. 2005).

The two instruments were used to assess soil compaction. Siqueira et al. (2010) have studied the correlation between ECa and SPR. They found negative correlation between SPR amd ECa measured by an inductance instrument EM38. The best correlation coefficient of r= - 0.695 was found between the Vertical position of the EM38 and the SPR at 0.30 to 0.40 m depth interval. They explain the negative correlation by the water content of the soil. High water content gives high ECa and low SPR. Jabro et al.(2006) have studied the relationship between SPR and ECa measured by a VERIS electrical resistivity instrument. They found very low negative correlation between the two.

During the last three years experiments studying soil tillage systems under different crop rotations were carried out in the University of Thessaly Farm at Velestino, Central Greece. During the experiment soil compaction was measured using a soil penetrometer and soil apparent electrical conductivity using an EM38. The results of these experiments are presented in the present paper.

2 Material and Methods

The tillage treatments were:

1. Conventional tillage (CT) using ploughing at 25-30 cm and 2-3 passes of a disk harrow at 7-9 cm or a light cultivator at 6-8 cm for seedbed preparation.
2. Reduced tillage (HC) using a heavy cultivator at a depth of 20-25 cm at 30-35 cm and 2 passes of a disk harrow or a light cultivator for seedbed preparation.
3. Reduced tillage (RC) with one pass of a rotary cultivator at 10-15 cm for primary tillage, and a second pass with rotary cultivator or one or two passes of a disk harrow or a light cultivator before planting.
4. Reduced tillage (DH) Primary and secondary tillage with a disk harrow at 6-8 cm for the winter crops and strip tillage for spring crops. For winter crops one or two passes for residue management and weed destruction and one or two passes for seedbed preparation before planting the crop. A strip tillage machine developed in the laboratory (lit) of farm mechanisation was used for spring crops.
5. No-tillage (NT). Direct planting using a no till pneumatic drilling for winter crops and a planting machine for spring row crops.. The plots were split in two parts. In one part all residues were removed and added to the other plot. That way one plot had double mulching material.

The following soil properties were measured: 1. Soil penetration resistance by using a Bush penetrometer with a 12.8 mm base diameter and 30^{o} angle. The instrument was able to record soil penetration resistance every 1 cm depth. The measurements were made in each experimental plot. Five measurements were made and the mean values for each depth were used 2. Soil apparent electrical conductivity by using an EM 38. Measurements were made by moving the instrument along the plot. Two modes of operation was used. The horizontal (H) measuring the ECa at 0-75 m depth and the vertical (V) measuring the ECa at 0-1.5 m depth. As the Horizontal mode is more sensitive to the surface layers of the soil the Horizontal mode was used for the present measurements. Three groups of measurements were

taken. From 25/6/2011 till 6/7/2011 five measurements were taken, from 25/2/2013 till 2/4/2013 six measurements were taken and from 21/6/2013 till 26/7/2013 twelve measurements were taken. Date analysis were made using Excel 2013 and SPSS.

3 Results and Discussion

Figure 3a shows the correlations of all data. An exponential curve is fitted with a high correlation coefficient of 0.73. Figure 3b shows the same data with a linear curve fitted with $R^2 = 0.69$. Figures 4 show the curve fitting of the tillage treatments of the experiment. In all cases the correlation is negative i.e that higher ECa is connected to lower SPR. The basic soil parameter that can explain this is the effect of soil water content has in the two measured parameters. ECa is larger with higher water content as electrons are moving freely through water and SPR is lower with higher water content. The same conclusions were drawn by Siqueira et al. (2010).

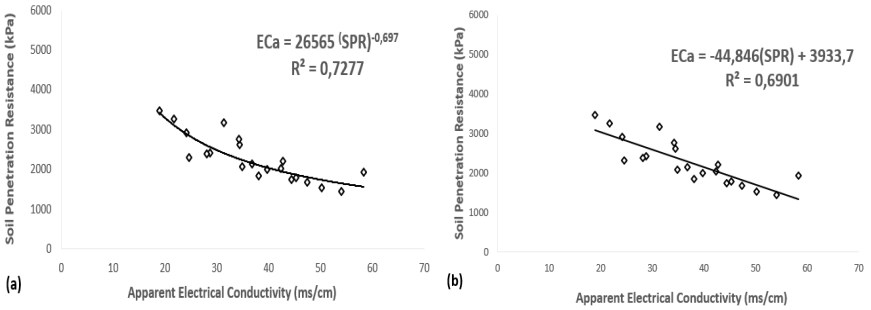

Fig. 3. a) Power regression model between SPR and ECa for all data taken and b) Linear regression model between SPR and ECa for all data.

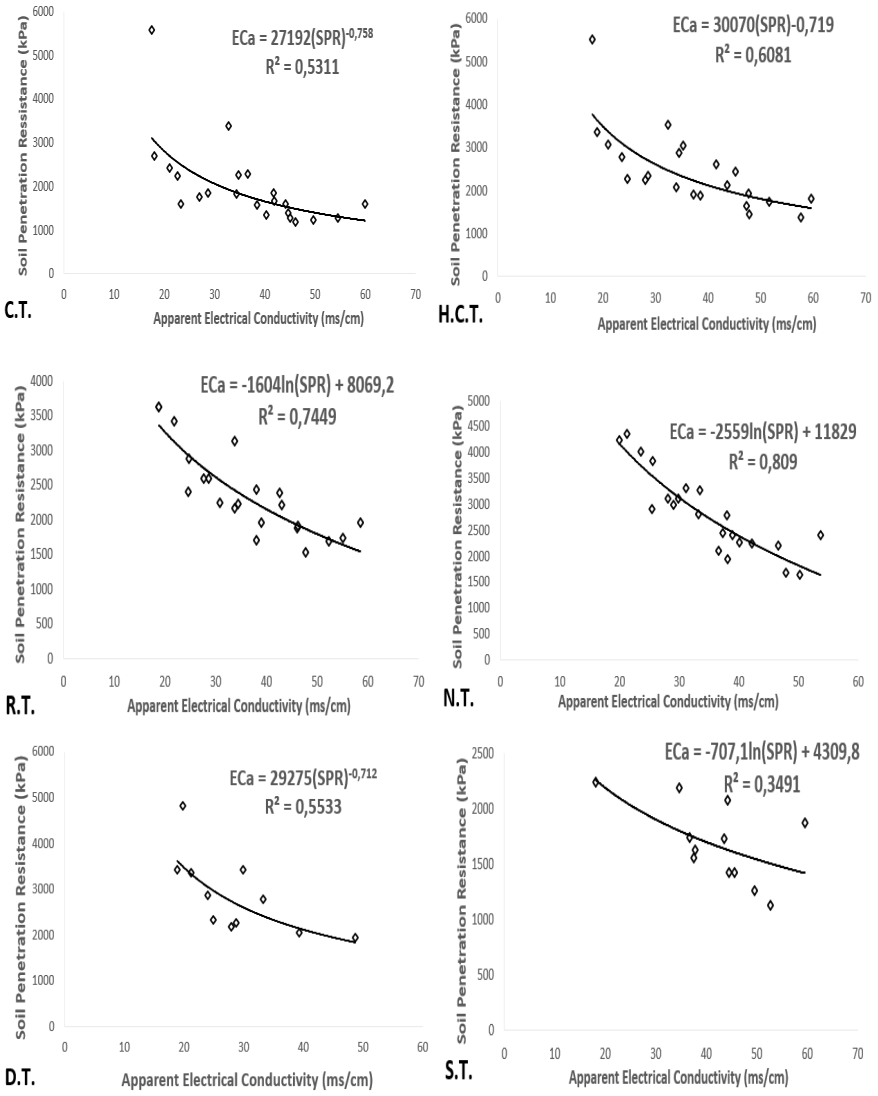

Fig. 4. Curve fitting for conventional tillage (CT), Heavy cultivator tillage (HCT), rotary cultivator tillage (RT), no-tillage (NT), disk harrow tillage (DT) and strip tillage (ST) treatments.

Table 1. Models connecting ECa and SPR

Tillage treatment	Regression curve	R^2
All field data	$EC_a = 26565 \times SPR^{-0,6972}$	0,73
Conventional tillage	$EC_a = 27192 \times SPR^{-0,758}$	0,53
Heavy cultivator	$EC_a = 30070 \times SPR^{-0,719}$	0,61
Rotary cultivator	$EC_a = -1604 \times \ln(SPR) + 8069,2$	0,74
Disk Harrow	$EC_a = 29275 \times SPR.^{-0,712}$	0,55
Strip tillage	$EC_a = -707,1 \times \ln(SPR) + 4309,8$	0,35
No Till	$EC_a = -2559 \times \ln(SPR) + 11829$	0,81

Table 1 shows the regression curves fitted to the data and the respective correlation coefficients. Strip tillage presents the lower correlation coefficient. This effect was expected as strip tillage is not homogeneous in all the area of the plot. Soil loosening is taking place only on the rows i.e. every 0.75 m while the rest of the soil remains undisturbed. Conventional and disk harrow treatments have the lower coefficients. But generally the other coefficients indicate high correlation and that RCa is a possible indicator of soil compaction.

If the results will be verified and the measurement of ECa at different depths can be achieved through the adjustment of the distance between the dipoles then the method can be used to assess soil compaction at different soil depths. This can be the basis to develop a variable rate (depth) tillage (soil disturbance) system or precision tillage system that can contribute to the reduction of energy consumption for tillage and help at improving energy productivity in agriculture.

4 Conclusions

From the results presented in this paper it can be concluded that:

- Different tillage treatments cause different residual compaction to the soil.
- ECa is negatively correlated to soil compaction measured by soil penetration resistance.
- ECa can be used to predict soil compaction at least under the conditions of the present experiment
- Correlation coefficients were higher in no till, heavy and rotary cultivator. Low correlation was found in stripe tillage and disc harrow due to the lower homogeneity of the tillage.

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Session 12: Data Analysis on Animal/Fishery Products Processes (part 2)

Exploring Traditional Routes of Seasonal Transhumance Movements with the Help of GIS. The Case Study of a Mountainous Village in Southwest Macedonia, Greece

Konstantina Ntassiou[1], Ioannis (John) D. Doukas[2], Maria Karatassiou[3]

[1]Surveyor Engineer, MSc., PhD in Civil Engineering, Aristotle University of Thessaloniki, Greece, e-mail: kntassiou@gmail.com
[2]Professor of Geodesy & Geomatics, Department of Civil Engineering, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece, e-mail: jdoukas@civil.auth.gr
[3]Assist. Professor, Laboratory of Rangeland Ecology, Department of Forestry and Natural Environment, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece, e-mail: karatass@for.auth.gr

Abstract: Transhumance is a traditional livestock system with the historical origin of many centuries. The seasonal migrations of flocks and people, in Greece and elsewhere, were held at predetermined paths and area-specific tactics. This paper explores the traditional transhumance routes between highlands of southwestern Macedonia, Greece and lowlands of either Macedonia or Thessaly, by adopting modern geo-informatics-tools, such as GIS. The adopted technology provides a powerful tool to visualize the traditional routes, to analyze the characteristic elements of each route, and to determine the criteria involved in the selection. The ultimate goal of this work is to bring out the traditional way of transhumance, not as a historical–museum piece of information but as an efficient farming system that (with the proper technological assistance) can be explored and applied by modern farmers, towards establishing an efficient and sustainable animal husbandry system.

Keywords: Geoinformation systems, GIS, transhumant farming system, seasonal movements, transhumance, moving-livestock routes

1 Introduction

Transhumance is a common practice of animal farming operating in Greece and other European countries for several centuries (Ruiz and Ruiz 1986, Olea and Mateo-Tomás, P, 2009, Pardini and Nori, 2011). This system dictates the movement of flocks twice a year (spring and autumn) in order to find food (grazing areas) and get protected from harsh, seasonal weather conditions, such as cold winters and hot summers for the mountainous and lowland pastures respectively. This is part of the so-called “extensive farming”, which is structured around free grazing animals and the use of natural pastures towards managing their annual and seasonal variation in productivity (Gomez Sal, 2000, Laga et al, 2003, Aryal, 2010). The historic paths of movements of both flock and people are used even today with much less intensity in

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terms of number of animals and flocks. The overnight positions (stops) or rest areas of these routes, already defined from the past, known as "Konakia" (singular: konaki, plural: konakia) reflect the nutritional needs of the livestock and the climatic and landscape particularities of the broader geographic area (Ntassiou, 2014). The animal walking paths as well as the stop areas should have to assure grazing (i.e. adequate forage production) and additional livestock activities such as milking, cheese-making etc.

The duration of the journey was estimated in number of "konakia" (stops, a kind of outdoor lodging), and not as a daily, walking distance. Konakia were usually located on open – non-forested areas (to eliminate wolf attacks), far from agricultural land (to avoid possible damage to cultivated areas) that as pointed out earlier assure food abundance and access to water. Apparently, there were several factors that were considered for establishing the temporal shelters of Konakia, that follow the rules of a well organized community, that might have been assessed over the years through a trial and error manner before assuming their current historic configuration (Ntassiou, 2014). Recent views consider maintenance of transhumance "on foot" as the most important factor, which can contribute to enhancing the adaptive capacity of agrarian societies to cope with global environmental change (Oteros-Rozas et al. 2013).

The current paper aimed to present the seasonal transhumance routes and define their characteristic elements in a broader geographical area as well as to explore the criteria used for the selection of both the route and the temporal overnight stop (rest) areas. To accomplish the above target we used a Geographical Information System that employs spatial analysis tools to collect, store and analyze information dealing with the geophysical variability of the environment.

As a case study we defined a transhumant route from a mountainous village of Southwest Macedonia to a lowland winter settlement in Thessaly. Specifically, we selected the mountain settlement Perivoli of the current Regional area Grevena, as a starting point for seasonal migrant flocks and farmers family and Argyropouli, Regional area of Larissa, as a winter destination. The route coincides with an important historical section of its path, which used to connect the wider region of Tyrnavos with Grevena and Vlachochoria of North Pindos (Wace and Thomson, 2009), throughout the period of the Turkish occupation Greece. Nowadays, some seasonal-moving flocks with their farmers do follow the same customary ('traditional') route. Thus, it is interesting to analyze the route both in terms of the axis and in terms of other characteristics (such as the location of konakia, vegetation and ecosystem types, etc.).

2 Data and Method

2.1 Oral Testimonies of Stock Breeders and Participant Observations

To reveal information regarding traditional transhumance routes, we developed a balanced questionnaire that was used to interview farmers who have systematically experienced the traditional practice of flocks' movement (Ntassiou and Tsotsos,

2014). Data were tape-recorded and additional information included by sources they were proposed by farmers.
In addition, to document a specific route we followed a flock during its fall transition from the highland area (Perivoli, Grevena) in the winter shelter (lowland area; Argyropouli, Larisa). During the tracking of this route, several representative positions of it were recorded (i.e. their corresponding coordinates) with the help of a GPS (Global Satellite Positioning System)-device (Series eTrex, of GARMIN™).

2.2 Cartographic Material and Geographic Background

The cartographic base which is used consists of 14 historical maps of the US Army (1953-1955 period). Features of this map-series are: (a). The sharpness of roads, trails, streams, rivers and water sources, either for the period to which they relate (aerial photographs, 1945) or for earlier years (b). The analytical names which often coincide with registered locations of «konakia» (Doukas et. al., 2015).

The software package ArcGis10™ was selected for the entry and processing of the available cartographic material, with the use of the Greek Geodetic Reference System GGRS 87 (EGSA 87) as the reference system for this research. The method of ground control points and the affine transformation was chosen for the georeference. Finally, map sheets were organized in directories (Raster Catalogs), so it is easier to use and edit them than each one separately.

For visualization needs of the geomorphology of the area, was considered necessary to create a digital terrain model (DTM). The 'Greek area' was downloaded from a NASAs website (ASTER GDEM[1]). This downloaded raster file underpins the creation of soil shading model, which sets the three-dimensional view of both, space and soil-slope maps.

The map-sheets and the digital terrain model are a part of a much bigger dynamic geodatabase which includes data network of moving farmers of the wider southwestern Macedonia-area (Ntassiou, 2014). The entities to be created and placed on the background are stored in the geodatabase in order to inform and enrich it with new data, whenever are available.

Finally, after the creation of the geodatabase in the software environment of ArcMap™ , there was the import of orthophoto-maps background (imagery) of the basemaps-collection, which enables the observation of objects in the contemporary geophysical space. In this way, a traditional route is provided in the contemporary space (with its effects emerging therein), while it is possible to observe the comparative data shown in historical American charts.

[1] http://asterweb.jpl.nasa.gov/gdem.asp

3 Results and Discussion

3.1 Recording of route and its overnight stay-positions (konakia)

Initially, the transhumant route and its konakia were recorded according to data derived from the oral testimonies of farmers. One of the narrators who experienced seasonal movement before the Second World War contributed to understand that the route path is not changed in time, but based on a tradition from which there was no possibility of deviation. In interviews attributed the detailed description of the routes and the toponyms of overnight stay-positions. Such information helped the final setting up of the route onto the geographical area (Table 1). The route was computed in time, based on the number of days that lasted an average movement.

Table 1. Route of transhumance and related 'konakia', from Perivoli to Argyropouli (duration 10 days)

Kiatra Lai (Perivoli area) - Tista (Ziakas) - Mavranaioi - Ag. Theodori (Vranes area) - Fountain Mustafa - Sioutsa - Lai - Kefalovriso - Aradosivia (Stefanovouno) - Argyropouli			
α/α	*konakia*	*α/α*	*konakia*
1	Fountain Exarchou	6	Lai
2	Tista (Ziakas) (Ag. Athanassios area)	7	Kefalovriso
3	Ag. Theodori (Vranes area)	8	Aradosivia (Stefanovouno)
4	Fountain Mustafa	9	Katatzol (Argyropouli)
5	Sioutsa		

3.2 Digital mapping of the route and konakia

The stopping-points (konakia) be identified on the map-background and digitized. Then, we proceeded with the tracking of the course and its setting up, according both to the roads (footpaths, etc.) shown in the older maps and the contemporary course, as well. The digitizing of the entire route resulted into an overall length about 135km. Thus, the length is an additional parameter to be taken into consideration, apart the duration (10 days). In order to provide spatial and descriptive information, the data formed properly, which obviously is important for the mapping and documentation of the route (Figure 1).

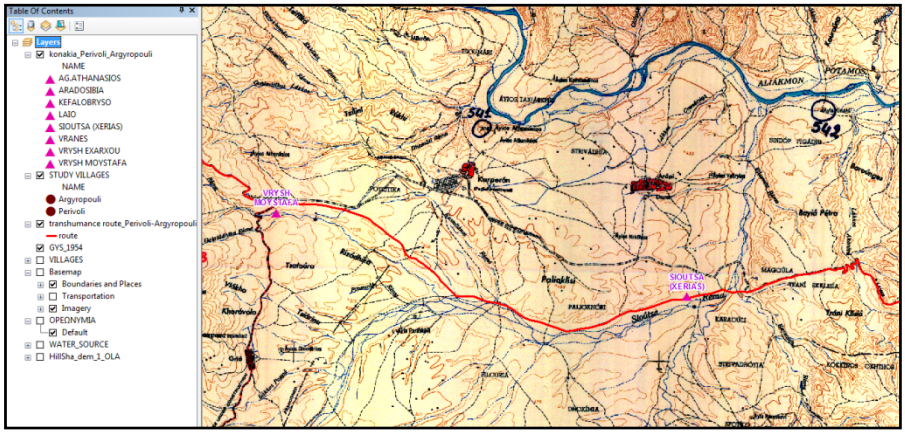

Fig. 1. The digitization of data in the cartographic base maps of the US Army (period 1953-1955).

3.3 Data processing and spatial analysis

By using the right tools of the GIS, there are feasible geo-processing and spatial analysis procedures that lead to miscellaneous conclusions on the traditional tactics of a move. For example, in certain zones of influence (buffer), that are created within the network of routes of flocks and stock farmers families (konakia-lodgings, route axes), the data contained in the respective surfaces can be analytically observed, whether they are digitized entities (settlements, founts, etc.) or part of the satellite image. Furthermore, the processing of data (concerning soil-surfaces, slopes, etc.), leads to the computation/creation of 'cost surfaces' used in finding optimal solutions for choosing routes or critical positions, in which an activity is under development.

3.3.1 Zones of influence

The course of a transhumance flock, by using the 'traditional' method, entails covering the nutritional needs, i.e. its appropriate grazing. The type of vegetation on both sides of the route-axis shows how apt is the path for food security, and accordingly determines the duration of the trip. In particular, good quality grazing at different points of the route decelerates the movement of the flock, as the optimum exploitation is desired. Conversely, the lack of appropriate vegetation or the existence of cropland is both acceleration factors for the movement of the flock. By defining appropriate 'zones of influence' in the GIS, conclusions are drawn about the effect of the movement of the flock in the landscape, as about the impact of the landscape on the efficient grazing for the flock. A zone-width of 300 meters either side of the route-axis demarcate the grazing area of the moving flock, a fact that allows the observation of vegetation and its interaction with the flock (Figure 2).

Around the konakia, areas of influence are formed, which include settlements, water founts or other points of interest. The number or type of items included in these areas of influence, determine the position of makeshift camps and of the grazing-areas for the flock during the stay. Also in the background of orthophoto-maps (Imagery) the natural features of the area around the konaki (such as vegetation cover, vegetation type and other factors affecting the choice of location for the night) are spotted. Demarcated areas (buffer) with a radius of 500 m to 1000 m, allow a more meaningful and detailed observation of these elements of the natural terrain (Figure 3). For example, the settlements located in a small distance around the konakia are characterized by a greater degree of interaction with the moving stock-farmer families. In the past, dairy products being manufactured in temporary camps from farmers were channeled in such settlements. Moreover, the intra-day stay of the latter in the area offered ample scope for developing relationships with the populations of these settlements (Ntassiou, 2014).

Fig. 2. Areas of influence around the axes of the routes, in zones of 600 m-width.

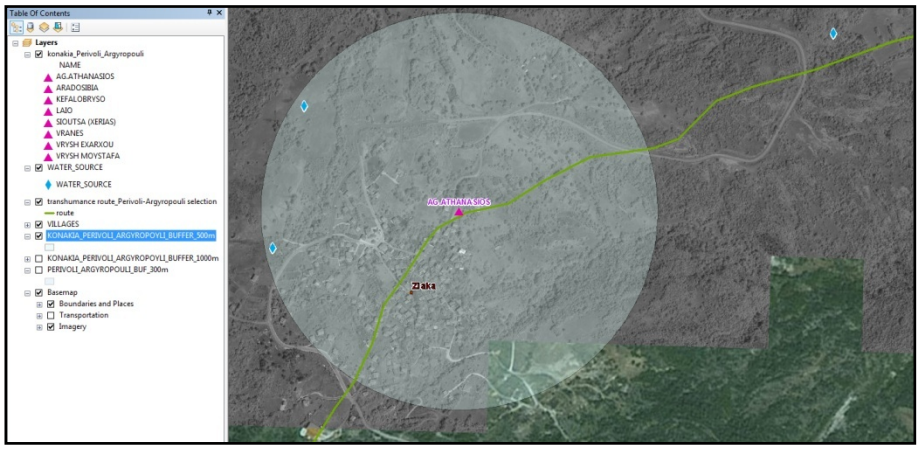

Fig. 3. An influence-area with radius of 500m, around the konakia near the village Ziakas where: water sources, the settlement and the land use that affects grazing, are mapped.

3.3.2 Identification of characteristic points on the routes

The digital terrain model created for the study area, through appropriate questions (queries) and the use of appropriate GIS-tools (Toolbox), led to the computation of Slope-surfaces, Aspect-surfaces and Hillshade-surfaces, concerning the soil. The selection of appropriate values for a surface (p.e. the slope or the aspect of the ground) and the application of the data-cut off on the selected surfaces, result into positions with characteristic values along a path.

For example, difficult parts of the route, such as those with a steep grade, can be designated by applying several 'scenarios' with slope-variations (Figure 4). With such experimentation, it is easy to detect and mark avoidable points of routes, where their axis follows p.e. a steep slope or a difficult helical-path or has the form of stairs. Such a difficult part of the route is detected in the location 'Skala Paliouria', near the settlements of 'Paliouria' and 'Friday' of Deskati (Figure 4) (Ntassiou, 2014). The remaining path of the route has no other difficult positions concerning steep slope (Figure 5).

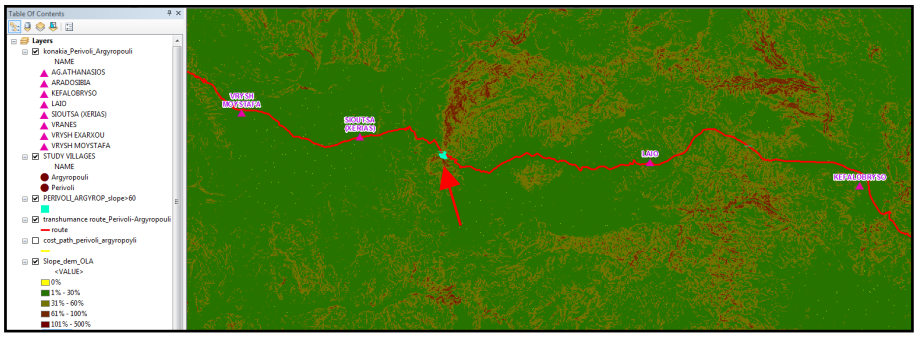

Fig. 4. Detecting points with steep slopes (> 60%) in the map-background. Indicating position 'Skala' which has such characteristics.

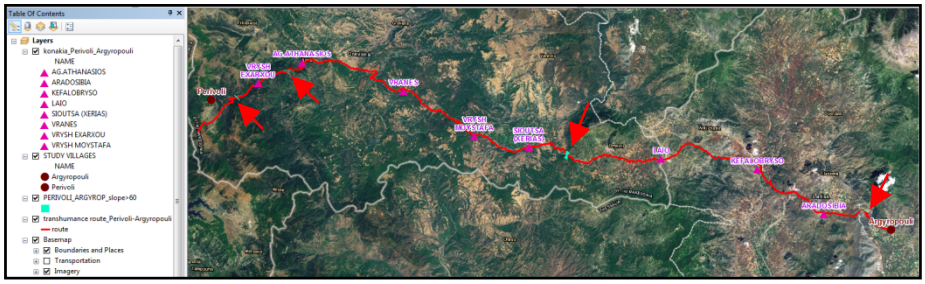

Fig. 5. Marked points with steep slope (> 60%) over the entire length of the route Orchard – Argyropouli

3.3.3 Findings on the relative position of digitized routes in relation to alternative routes (paths of minimum cost)

A cost-surface is the mathematical surface that models the costs of moving, from a specified source location to one or more destination locations (Papadimitriou, 2011). Where the term 'cost' here, means: the 'consumption' of energy or time, when moving in any cell of a raster map and the final 'sum' of this consumption when crossing map segments (Papadimitriou, 2011). By using such GIS-special tools, cost-surfaces are computed and illustrate the relative difficulty (or ease) of movement. Consequently, with their help, the best solutions to travel can be determined.

For the present paper, a model calculating the shortest path created (Figure 6) (Ntassiou, 2014), between two villages. In this model, the slope-surface of soil used as a cost-surface (cost-raster), because the combination of soil-slopes with the shortest possible path sufficiently identifies the optimal route.

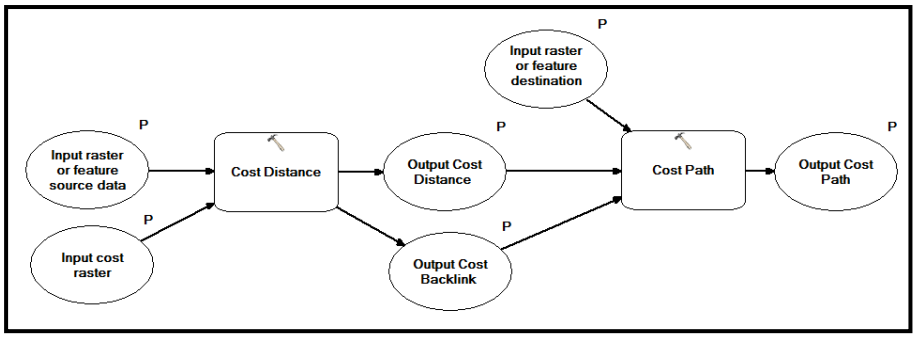

Fig. 6. Model for determining optimal path (cost path)

The comparison between the relative position of the digitized route and the corresponding minimum cost-path (cost path), shows that the course does not follow the total length of the best solution, for the shortest distance and smoother gradients (Figure 7). Specifically, the points of divergence identified in Section Orchard - foot of mountain Orliakas (village Ziakas) and in a part of position Sioutsa - Aradosivia (Stefanovouno).

In the first of these divergent sections, the existence of historical old path passing mountain Orliakas justifies the development of the traditional route, which corresponds to the path. Also in the second part of these divergent sections, the deviation is explained by the existence of a basic road that linked Grevena with Elassona (since the Turkish occupation). The traditional route of seasonal migrant flocks and livestock families follows alongside this old basic road (Figure 8). It is obvious that the traditional route followed by the flocks during their transhumance (from the mountainous settlement to lowlands and vice versa), does not deviate from the roads and some points deviate minimally, just to exploit grazing.

In the past (even before the Second World War) in Greece, the mild lands and the shortening of travel were not important criteria in defining a route. Crucial role in

choosing routes played additional factors such as the vegetation type, the accessibility of rivers, the crossing of important settlements, the climatic conditions.

Moreover, for the choice of a path axis the existence of appropriate grazing was a determinative factor to a significant degree. In particular, during the autumn migration to lowland places (which in most cases were extended in time), the distance-criterion was not of importance (Ntassiou, 2014).

Fig. 7. The position of the route Perivoli-Argyropouli (red line), length: approx. 135km, in relation with the 'least cost-path' (yellow line), length: approx. 120km.

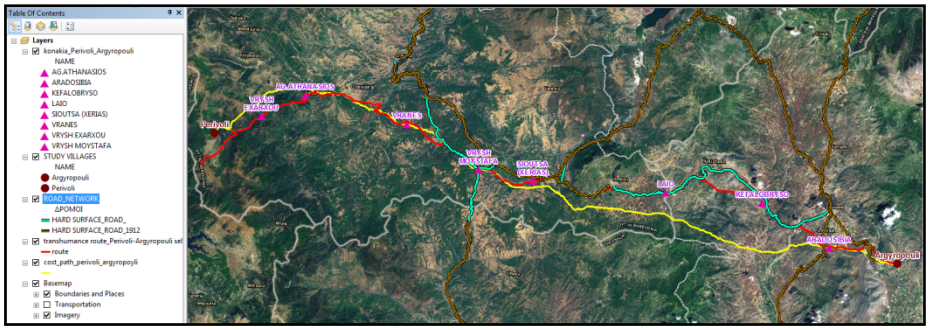

Fig. 8. The position of the route Perivoli-Argyropouli (red line), in relation with the 'least cost-path' (yellow line). Also, the historical roads of the period 1912-1940 are illustrated (with green and brown line, respectively).

4 Conclusions

The GIS developed for this research, contributes to the detailed visualization and strong promotion of a traditional transhumance route. Even more, it provides 'functional' results useful for younger, novice farmers. Concerning the oral tradition, the data organized with the help of appropriate historical cartographic material and stored in the corresponding geodatabase, making it available to future generations, even for historical studies of transhumance flocks. The dynamic character of the geodatabase allows continuous data stream (in-out), which makes it possible to

extend the boundaries of the geographic study area and of course, the easy conformation and adaptation of geodatabase to any world region.

Apart from the historical and cultural value of the method, the credit of the technical characteristics of a traditional route as well as their proper processing and analysis, makes more understandable the 'technical part' of the traditional movement. The new moving farmer can form a 'criterion-picture'. With these criteria, he/she will be able to identify both, an appropriate path and how he/she will move on this path. Thus, GIS can be a way of learning a part of the customary ('traditional') way of movement for the novice farmer, who does not know the details of this tactic.

With the addition of extra data in the geodatabase system (e.g. climatic and meteorological data, land use maps, geological maps, etc.), the developed methodology can lead to the reasonable enrichment of the conclusions.

Within the nowaday standards, this method has a strong potential for development and expansion, especially from the 'decision-making' and 'management' points-of-view, while maintaining vibrant its historic and cultural character.

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Isolation of Toxic Marine Cyanobacteria and Detection of Microcystins in Thermaikos Gulf in Central Macedonia in Greece

Maria Kalaitzidou[1], George Filliousis[2], Evanthia Petridou[3], Vangelis Economou[4], Alexandros Theodoridis[5], Panagiotis Angelidis[6]

[1]Region of Central Macedonia Greece, General Directorate of Rural Economy and Veterinary, Directorate of Rural Economy and Veterinary of Regional Unit of Thessaloniki, Veterinary Department, Greece, e-mail: M.Kalaitzidou@pkm.gov.gr
[2]Laboratory of Microbiology and Infectious Diseases, School of Veterinary Medicine, Faculty of Health Sciences, Aristotle University of Thessaloniki, Greece, e-mail: georgefilious@vet.auth.gr
[3]Laboratory of Microbiology and Infectious Diseases, School of Veterinary Medicine, Faculty of Health Sciences, Aristotle University of Thessaloniki, Greece, e-mail: epetri@vet.auth.gr
[4]Laboratory of Hygiene of Food of Animal Origin, School of Veterinary Medicine, Faculty of Health Sciences, Aristotle University of Thessaloniki, Greece, e-mail: boikonom@vet.auth.gr
[5]Laboratory of Animal Production Economics, School of Veterinary Medicine, Faculty of Health Sciences, Aristotle University of Thessaloniki, Greece, e-mail: alextheod@vet.auth.gr
[6]Laboratory of Ichthyology, School of Veterinary Medicine, Faculty of Health Sciences Aristotle University of Thessaloniki, Greece, e-mail: panangel@vet.auth.gr

Abstract. The presence of toxic marine cyanobacteria and secondary metabolites, microcystins, were studied in Thermaikos Gulf in Central Macedonia in Greece, during the period from March 2013 to March 2014. Toxic marine cyanobacteria were isolated in marine agar and identified with PCR using primers based on 16S rDNA. The presence of microcystins in water extraction was detected by immunoassay (competitive ELISA). The concentration was ranged from 0.15 to 5ppm. It was observed that populations of toxic marine cyanobacteria were increasing during spring and early winter and there was a correlation to the physical and chemical parameters of the water. The percentage of microcystins was 20.8 % and there were significant differences ($p<0.05$) between the areas and the seasons.

Keywords: cyanobacteria, microcystins, water bloom, Thermaikos Gulf.

1 Introduction

Cyanobacteria (blue-green algae) occur in freshwater, brackish and marine environments (Lawton and Cood, 1991). Toxic species can be potentially hazardous for animal and public health, since the toxins known as cyanotoxins are produced during eutrophication periods (Hitzfeld *et al*.; 2000). Poisoning by cyanotoxins has been described in humans and animals (Carmichael, 1997; Chorus *et al*., 2010). Cyanotoxins act as inhibitors of protein phosphatases 1and 2A (PP1 and PP2A),

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inducing apoptosis and necrosis of the hepatocytes (Dawson, 1998). Moreover they cause diarrhea and skin irritations (Chernoff *et al*., 2002; Martins *et al*., 2005).

Microcystins, which are cyclic heptapeptides, are cyanotoxins that exhibit toxic activity due to a unique amino acid, Adda (3-amino-9-methoxy-2,6,8-trimethyl-10-phenyl-4,6-dienoic acid) (Codd *et al*., 1999; Hitzfeld *et al*., 2000). More than 70 analogues of microcystins have been described (MacElhiney & Lawton, 2005). Although microcystins have been widely studied in fresh and brackish waters, the bibliography is limited concerning microcystins in marine waters (Lawton and Cood, 1991). The presence of microcystins in the marine environment has been reported in seawater from the Atlantic Ocean, the Caribbean, the Pacific, the Indian Ocean, the Arabian Sea the Marmara Sea, and the Mediterranean Sea (Martins *et. al*., 2005; Taş *et al*., 2006). In Greece there is only a report from Amvrakikos Gulf, which confirmed the presence of microcystins in marine waters at levels ranging from 0.003 to 19.8 ng 1^{-1} (Vareli *et al*., 2012).

Although intense human activity such as fishing, shellfish farming and tourism take place in the Thermaikos Gulf, there are no data concerning toxic marine cyanobacteria. Thermaikos is a semi-closed gulf located in the northwest of Aegean Sea, with a surface of 5.100 km^2. It is one of the major productive areas of Central Macedonia and generally Greece. The north limit is the bay of Thessaloniki with maximum depths up to 27m (Nikolaidis *et al*., 2006), the west is the region of Pieria and the east is the peninsula of Kassandra. In the south limit the gulf opens to Aegean Sea with a maximum depth up to 90m. Thermaikos Gulf is enriched by three big rivers, Axios, Loudias, and Aliakmonas and a small one, Gallikos. The annual runoff mainly from November to May amounts to 150 m^3s^{-1} (Ganoulis, 1988). The sediment fluxes from the surrounding areas are 500 tn km^{-2} per year (Poulos *et al*., 2000). These include nitrate and phosphate salts due to fertilizer application in the adjacent crops.

The possible impact of cyanotoxins on people practicing recreational or occupational activities in Thermaikos gulf is of concern. Many cases of skin and eyes irritations, diarrhea, asthma and allergic reactions have been reported after swimming in marine waters, where cyanobacteria bloom had occurred (Chorus *et al*., 2000; Stewart *et al*., 2009). In addition toxic marine cyanobacteria constitute an occupational hazard for fishermen, water sports teachers, cleaners and maintainers of coasts, fish and shellfish farmers and divers (Stewart *et al*., 2009). Also it is reported that toxic marine cyanobacteria inhibit grazing of zooplankton (Figueiredo *et al*., 2004) and may be toxic to it and to crustaceans (Carmichael, 1992). Studies in mussel's embryos report that cyanobacterial extracts from *Synechocystis* spp. and *Synechococcus* spp. caused total inhibition of embryogenesis (Martin *et al*., 2007). This report is of importance for shellfish production of Thermaikos gulf since it provides 90% of mussel production annually of Greece.

The morphological characteristics of Thermaikos Gulf, the enrichments and the climate conditions of North Greece, especially of Thessaloniki can induce eutrophication problems mostly near the shallow coastal zones (Koukaras, 2004; Nikolaidis *et al*., 2006). The scope of this research was to identify the toxic marine cyanobacteria and to detect the presence of microcystins in Thermaikos Gulf.

2 Materials and methods

2.1 Field Sampling and Handling

During 2013, 120 water samples were collected from Thermaikos gulf every three months, with the exception of the winter months. The sampling points were selected according to their ecological and economic importance, with selected points having intense fishing, shellfish farming and recreational activities. The sites were: **1**. Chalastra area in Thessaloniki region (40º 32′ 20.12′′N and 22º 44′56.63′′E) **2**. Aggelochori area in Thessaloniki region (40º 29′30.05′′N and 22º 49′11.79′′E) **3.** Makrigialos area in Pieria region (40º24′57.98′′ N and 22º37′14.93′′E) **4.** Klidi area in Imathia region (40º28′37.03′′N and 22º39′58.94′′E). Sampling was performed by a portable hose sampler, which was submerged at a depth of 2 m. After receiving the water column, 500ml of marine water were transferred into a sterile flask. Salinity, oxygen saturation, pH and temperature of the water were measured in the field with an YSI 556 handheld multiparameter instrument (YSI Incorporated, Ohio, USA). The samples were transferred in the laboratory in insulated cold boxes. 150 ml were filtered through filters with 0.45μm pore diameter (PALL CORPORATION, 600 South Wagner Road Michigan). One filter was used for culture and one was stored in freezer at -80ºC until microcystin detection.

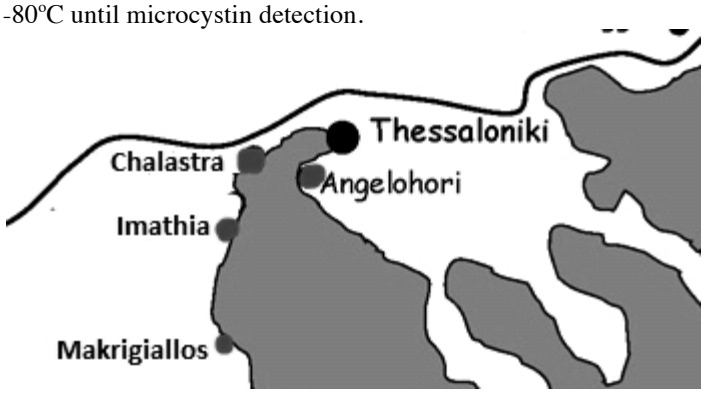

Fig. 1. Sampling areas in Thermaikos Gulf

2.2. Cyanobacteria isolation and identification

After filtration the filters were placed on Marine Agar growth medium (CONDA S.A. Torrejon de Ardoz, Madrid Spain) supplemented with imipenem (50mg l^{-1}, BIO-RAD, München, Germany) (Ferris and Hirsch, 1991) and kanamycin (50mg l^{-1}, BIO-RAD, München, Germany). The petri dishes were incubated up to 21 days at 25ºC under cool white fluorescent light (700LUX), with a 14:10 light:dark cycle and monitored for growth at the seventh, tenth, fourteenth and twenty first day of incubation. Colonies showing typical morphology were observed in an optical microscope (Olympus CH30) after Gram staining. The morphology characteristics were used to characterize cells as to *Synechocystis* spp. according to Anagnostidis

and Komárek (1985). In brief cells that were coccoid, nanoplaktonic morphology with a diameter of 1 to 4 μm, organized as single cells, doublets of dividing cells, and cloverleaf-type cell aggregates were characterized as presumptive.

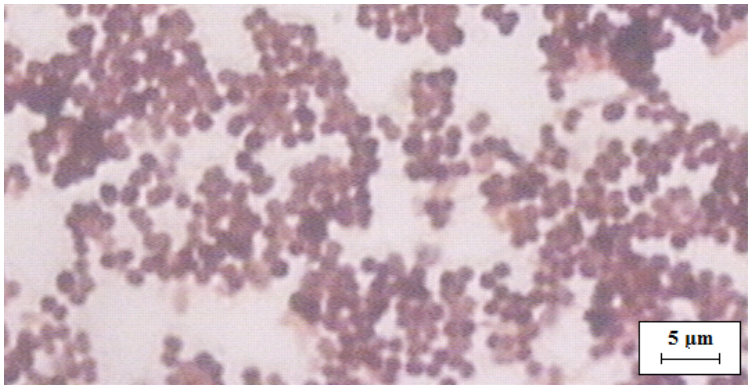

Fig. 2. Marine cyanobacteria cells after Gram staining.

Colonies showing typical morphology were harvested and passaged in Marine Agar. The cultures were considered axenic after two passages, and further identified with PCR, using specific primers for the amplification of the cyanobacterial 16S rDNA fragments (Forward primer 27f 5'-AGA GTT TGA TCM TGG CTC AG, reverse primer 1525r 5'-AAG GAG GTG WTC CAR CC) (Svenning *et al.,* 2005).

2.3 Sample Analysis for Microcystins

For microcystins detection the frozen filters were dissected and extracted with methanol (Merck, Germany). The extraction was performed with a 75% aqueous solution of methanol, since it is reported to be the most suitable for microcystins extraction (Rodriguez *et al.,* 2005). The filters were cut in squares pieces of 2-3 mm acne and put in 10 ml methanol overnight. The supernatant was transferred into 50 ml tubes, 10 ml of methanol 75% were added in the pellets. Then they were heated at 55ºC for 15 min, centrifuged at 3000rpm for 20min at 4ºC and the supernatant was collected and transferred into the 50ml tube. This procedure was repeated once more, the extracts were pooled and concentrated using rotary evaporation until dry, dissolved in 1ml methanol 75% and filtered through syringe filters.

The extracts were examined for microcystins with the commercial immunoassay method Microcystins (Adda specific) ELISA kit according to `manufacturer's instructions (Enzo Life Sciences Inc, USA). The detection limit was 0.10ppb microcystin-LR analogues. The absorbance was read at 450nm using a microplate ELISA photometer (DAS model A3, Italy). Calculation of microcystin concentration was performed according to the standard curve plotted against standard concentrations of 0.15, 0.40, 1.00, 2.00, 5.00 ppb of microcystin-LR analogues.

2.4 Statistical Analysis

The presence of cyanotoxins was measured as the percentage of microcystins at concentrations higher than 1 ppb, within the selected samples. The relation of the toxins frequencies to region and season was evaluated using the chi-square test of independence (χ^2-test). The chi-square test of independence was applied to determine whether there is a significant association between two variables or not. Analysis of Variance (ANOVA) was performed to evaluate possible effects of season and region, as well as their interaction, on toxins concentration, temperature, ph and salinity. Differences between mean values of specific factors were evaluated using the Duncan's new multiple range test. The statistical analysis was conducted using the SPSS software program and significance was declared at $p \leq 0.05$, unless otherwise noted.

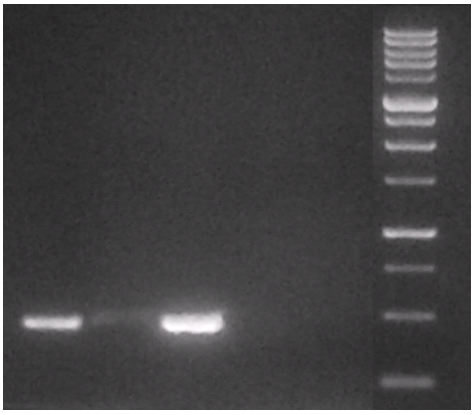

Fig. 3. PCR detection of 16S rDNA of cyanobacteria.

3 Results and Discussion

Our research confirmed the presence of toxic marine cyanobacteria in Thermaikos gulf by culturing of cyanobacteria in a novel medium, marine agar supplemented with imipenem and kanamycin. We found that the combination of imipenem and kanamycin at the final concentrations of 50mg l^{-1} helped to reduce saprophytic microbial flora and greatly enhanced the easiness and possibility of obtaining axenic cultures. ELISA showed that concentrations of microcystins varied from 0.15 ppb in late summer and late autumn to 5.00 ppb in spring and early autumn. April, May and June were the months with higher toxin concentrations. It was found that 20.8% of the samples had concentrations higher than 1 ppb (Table 1). The percentage of positive samples were higher in Aggelochori and Makrigialos areas (36.7% and 26.7% respectively), while Chalastra and Imathia had lower ones (13.3% and 6.7% respectively).

The number of positive samples varied had shown a seasonal variation (Table 2). In Chalastra and Aggelochori the number of positive samples was higher during

spring (3 and 6 positive samples respectively). On the other hand in Makrigialos the number of positive samples was higher during autumn (5 samples). This can be explained by the position of the sampling points in regard of the discharges of Axios River. The outfall of Axios is near the Chalastra and Aggelochori sampling points which are situated in the greater vicinity of it. Whereas the Imathia (approximately 6 km) and especially Makrigialoas (approximately 14 km) . The sampling points in these areas are located near to Delta of Axios, which is the second most polluted river in Greece (Skoulidis, 1993). The discharges of Axios are higher during spring reaching the 279 m^3 sec^{-1} (Poulos *et al*., 2000; Koukaras, 2004) since they are connected to the snowmelt from mountains in FYROM (Poulos *et al*., 2000). In addition the gulf streams which are south-south east during spring and summer (Koukaras, 2004), transfer big amounts of water masses from Chalastra to Aggelochori.

Table 1. Presence of toxins in marine waters for each region

Regions	Presence of toxins N (%)
Chalastra	4/30 (13.3%)
Makrygialos	8/30 (26.7%)
Imathia	2/30 (6.7%)
Aggelochori	11/30 (36.7%)
Total	25/120 (20.8%)

Table 2. Presence of toxins in marine waters in each region according to seasons

Regions	Seasons			
	Spring	Summer	Autumn	Total
Chalastra	3/10	1/10	0/10	4/30
Makrigialos	2/10	1/10	5/10	8/30
Imathia	0/10	1/10	1/10	2/30
Aggelochori	6/10	3/10	2/10	11/30
Total	11/40	6/40	8/40	25/120

The test of independence show that there is a significant association between the concentration of the toxins and the region (p-value= 0.02). Significant differences in microcystins concentrations were observed within areas in spring and autumn as it is shown in Table 3.

Larger microcystin concentrations were observed in samples from Aggelochori sampling point. This can be explained by the proximity of the sampling point to urban waste treatment facility, where all the sewage of Thessaloniki, the second bigger city in Greece, is processed.

Regarding the physical and chemical characteristics of the water, temperature ranged from 13ºC to 23ºC depending on the season, ph from 7.80 to 8.79 and salinity from 34.8 to 38‰. Oxygen saturation was 75-80%. Tables 4 and 5 show the mean temperature values between areas in different seasons and significant differences of ph and salinity according to seasons respectively. Statistical analysis has revealed

significant effects of the physicochemical characteristics to the growth of toxic cyanobacteria, especially during spring and autumn.

Table 3. Microcystin concentration differences within areas according to the season (ppb)

Seasons	Regions			
	Chalastra	Makrygialos	Imathia	Aggelochori
	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Spring	1.55±2.05^{ac}	1.06±1.42^{ab}	0.35±0.22^{b}	2.25±1.53^{c}
Summer	0.58±0.71^{a}	0.75±0.21^{a}	0.41±0.29^{a}	1.15±0.88^{a}
Autumn	0.60±0.29^{a}	1.75±1.72^{b}	0.67±0.39^{a}	0.97±0.38^{a}
Total	0.91±1.31^{ab}	1.18±1.31^{a}	0.47±0.33^{b}	1.45±1.16^{a}

* Different uppercase letters indicate statistically significant differences.

Our results show a seasonal growth of toxic marine cyanobacteria in Thermaikos gulf during spring and early autumn. Seasonal distribution of cyanobacteria especially in these seasons have been reported previously (Magalhães *et al.,* 2003; Taş *et al.,* 2006; De Pace *et al.,* 2014) that also report that cyanobacterial blooms in fresh, brackish and marine waters are observed mainly during late spring and early winter, especially in May or September.

Table 4. Temperature differences among seasons (°C) in each area

Seasons	Regions			
	Chalastra	Makrygialos	Imathia	Aggelochori
	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Spring	13.30±0.67^{abc}	12.70±0.48^{b}	14.50±0.53^{c}	14.00±1.33^{abc}
Summer	19.70±2.58^{a}	20.00±1.76^{ab}	18.70±2.58^{a}	21.50±1.78^{b}
Autumn	16.00±3.16^{a}	19.50±1.58^{c}	20.60±2.76^{b}	18.40±0.52^{c}
Total	16.33±3.53^{a}	17.40±3.64^{b}	17.93±3.35^{b}	17.97±3.38^{b}

* Different uppercase letters indicate statistically significant differences.

The high water temperatures generally reported in Greece can contribute in marine cyanobacteria bloom, confirming that temperature is the most important physical parameter which affects growth rates of bloom forming cyanobacteria (Davis *et al.,* 2009). Moreover the four rivers enrich the gulf through the runoff of large quantities of nutrients, including nitrate and phosphate salts from adjacent farmlands, increasing the risk. Discharges of freshwater (rivers or lakes) into coastal marine environments inducing toxic cyanobacteria bloom, have been described in Marmara Sea (Taş *et al*., 2006) and in Adriatic Sea from lake Occhito (De Pace *et al*., 2014).

Microcystin concentration in Thermaikos gulf is of great concern, since the upper mean limit was 2.25±1.53 ppb in Aggelochori area during May. The larger concentration observed were above the Tolerable Daily Intake (TDI) recommended by the World Health Organization (0.04μg $kg^{-1}d^{-1}$). This concentration is higher than the one in Amvrakikos Gulf (19.8 ppt), despite that Amvrakikos is a shallow gulf, low salinity, with two major rivers (Louros and Arachthos) draining into this gulf and considered the most polluted gulf in the Ionian Sea (Economou *et al*., 2007). In Amvrakikos gulf high concentrations of microcystins were observed in mussels

Mytilus galloprovincialis, at levels ranging from 45±2 to 141.5±13.5 ppt w/w (Vareli *et al*., 2012). Other studies from Mediterranean Sea confirmed the presence of microcystins in marine environment. In Adriatic Sea the concentration of microcystin in water was 0.61 ppb in May 2009, after a cyanobacterial bloom in Lake Occhito (De Pace *et al*., 2014).There are several reports of microcystin accumulation in seafood from the Baltic Sea (Luckas *et al*., 2005). In Sebetiba Bay in Brazil the concentration of microcystins in marine waters due to *Synechocystis* spp. bloom in June 1999 was 0.12 μg l^{-1}.Microcystins were detected also in fisheries and crustaceans with the largest concentration (0.198μg $kg^{-1}d^{-1}$) observed in a crab sample in September and was 13 times above the upper limit posed by the World Health Organization (Magalhães *et al*., 2003).

Table 5. ph and salinity (‰) differences according to seasons

Seasons	Parameters	
	ph	Salinity
	Mean±SD	Mean±SD
Spring	8.28±0.28[a]	35.10±0.76[a]
Summer	8.09±0.12[b]	34.50±2.08[b]
Autumn	8.00±0.25[c]	35.50±1.40[a]
Total	8.12±0.25	35.03±1.54[b]

* Different uppercase letters indicate statistically significant differences

In conclusion from our results it is found that marine cyanobacteria can be isolated in marine agar medium with the addition of imipenem and kanamycin at a final concentration of 50mg l^{-1}. The presence of toxin producing marine cyanobacteria in Thermaikos gulf is seasonable, especially during spring and winter. The physical and chemical parameters of the water (temperature, ph and salinity) conducive to the development of marine cyanobacteria. The high levels of microcystins especially during late spring and early autumn are of awareness, since they are considered hazardous for public health, aquatic animals and the marine ecosystem.

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Technical Efficiency of Shrimp and Prawn Farming: Evidence from Coastal Region of Bangladesh

Mst. Esmat Ara Begum[1], Mohammad Ismail Hossain[2], Maria Tsiouni[3] and Evangelos Papanagiotou[4]

[1]Senior Scientific Officer, Bangladesh Agricultural Research Institute, Joydebpur, Gazipur, Bangladesh, e-mail: esmatbau@yahoo.com
[2]Associate Professor, Department of Agribusiness and Marketing, Bangladesh Agricultural University, Mymensingh, Bangladesh, e-mail: ismailho12@yahoo.co.in
[3]PhD candidate, Department of Agriculture Economics, Agriculture School of Aristotle University of Thessaloniki, Greece, e-mail: mtsiouni84@yahoo.gr
[4]Professor, Department of Agriculture Economics, Agriculture School of Aristotle University of Thessaloniki, Greece, e-mail: papanag@agro.auth.gr

Abstract. Shrimp and prawn farming in Bangladesh have experienced spectacular growth in response to expanding global demand and higher economic return. In 2011, 180 shrimp and prawn farms were surveyed in Bangladesh to estimate their production efficiency and determine factors affecting the efficiency level. The results show that there are substantial inefficiencies among shrimp and prawn farms. The technical efficiency ranges from 55% to 97% (Mean±SD: 88±9%) for shrimp farms and from 39.56% to 99.79% (72.41±16%) for prawn farms, suggesting that shrimp and prawn farms could increase their output by 12% and 27.59%, respectively. For a land scarce country like Bangladesh this gain could increase income and ensure better livelihood for farmers. The results of the stochastic production frontier approach indicate that farmers could operate at an optimal scale for increasing their product. Farmers' education, training, age and water quality significantly affect efficiency.

Keywords: Technical efficiency, shrimp and prawn, coastal region, Bangladesh.

1 Introduction

Bangladesh is widely recognized as one of the most suitable countries in the world for brackish water shrimp (marine crustacean) (*Penaeus monodon*) and freshwater prawn (*Macrobrachium rosenbergii*) farming because of its favorable resources and agro-climatic conditions. A sub-tropical monsoonal climate, low laying agricultural land, saline water availability and a vast area of shallow water provide ideal conditions for shrimp and prawn production (Ahmed *et al*., 2008a). Within the frame of the agro-based economy of the country, the contribution of shrimp and prawn production has been considered to hold good promise for creating jobs, earning foreign exchange and providing protein to an undernourished population. During the

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last three decades development of shrimp and prawn farming has attracted considerable attention due to its high export potential. The prawn and shrimp sector is the second largest export industry after readymade garments, generating US$396 million annually and contributing by 5.7% to the total value of exports (DOF, 2013). During 2012-2013, Bangladesh exported 50,333 tons of prawn and shrimp, valued at US$ 337.62 million, 82% of which was shrimp and the remaining 18% was prawn (Export Promotion Bureau, (EPB), 2013).

Bangladesh, like most tropical countries, derives fish from a large number of complex natural systems. In 2012-13, 3,410,254 MT of total fish were produced in Bangladesh of which 82.73% came from inland sources. Of the inland sources, 65.92% of the total catch came from the culture sector and the rest from the capture fisheries. Four sources culture fishes are: baors, ponds and ditches, commercial shrimp farms and semi-closed floodplains. Baors or oxbow lakes account for a negligible number of fish catch. In 203, 88% of total inland culture fish came from the ponds and ditches. Commercial shrimp farms account for about 11% of total culture fish catch. Marine fisheries represented about 17.27% of total catch. Most of it comes from marine artisanal source (87.60%).

In 2010, the total area under shrimp and prawn farming was estimated to be around 275,274 hectares (Ministry of Fisheries (MOF), 2013) while in 1980 it was 20,000 hectares, indicating an average increase of 35% per annum (Department of Fisheries (DOF), 2013. This level of expansion reflects the government's priorities as shrimp and prawn farming are recognized as an essential component of economic development for the country. Most shrimp and prawn farms (53%) are located in southwest Bangladesh mainly in the districts of Bagerhat, Khulna and Satkhira, and produce 46% of country's total shrimp and prawn production (DOF, 2013). The families of southwest Bangladesh having a high population density tend to be resource poor, income poor and vulnerable to environment, climate and economic variability (Bundell and Maybin, 1996; Muir, 2003). Shrimp and prawn farming therefore creates prospects for increased income and sustainable livelihood for farmers. The most spectacular boost of shrimp and prawn farming have taken place in the Satkhira and Bagerhat districts where a large number of farmers have converted their rice fields to profitable shrimp and prawn farms (Ahmed *et al*., 2008b). In spite of the spectacular expansion of shrimp and prawn farms during the last decades, as well as the adoption by some farms of semi-intensive systems that produced higher yields, still the average yield is low compared to other Asian countries. Moreover, the expansion of shrimp and prawn farms have been accompanied by disease outbreaks and environmental degradation including destruction of vegetation and social forests, reduction in crop production (especially rice) and pasture land that have spread and threaten the sustainability of shrimp and prawn production. Disease outbreaks and environmental degradation have resulted from increased competition for limited resources linked to intensified production, overuse of chemicals, absence of proper water treatment and degradation of water quality. Besides its direct economic losses, long-term environmental degradation also creates losses that are irreversible and irrecoverable. Therefore, new ways of developing and expanding this sector in an economically viable and environmentally sustainable manner need to be identified. In this respect, among many other factors, increasing the efficiency of resource use in shrimp and prawn production at the farm

level stands as an attractive option because it has the potential to generate output growth without increasing quantities of inputs generating negative environmental externalities. Based on this promises, this paper estimates the level and the determinants of technical efficiency in an attempt to modify the management strategy and increase shrimp and prawn farming productivity in Bangladesh. The objectives are pursued in parallel for two different production systems that both play important roles in Bangladesh aquaculture. The first one corresponds to shrimp culture in brackish water and the second one, corresponds to prawn culture in freshwater.

A number of studies have been conducted on shrimp and prawn farming in Bangladesh, including, technical efficiency of shrimp farming (Begum *et al.,* 2013), economic analysis of shrimp farming (Alam *et al.,* 2007), determinants of efficiency in prawn farming, conversion of rice fields to prawn farms (Ahmed *et al.,* 2010a), and sustainability of freshwater prawn farming (Ahmed *et al.,* 2010b). However, there is a lack of studies on the production performance and resource use efficiency of shrimp/prawn farming in Bangladesh, which is the major source of expansion of the shrimp/prawn industry in the country. In this context, a stochastic production frontier model is applied to investigate the level of technical efficiency as well as the factors that have an effect on the estimated (in)efficiency of shrimp/ prawn farming in Bangladesh. This study is expected to generate information that will be useful for farmers in adopting best observed production techniques, in identifying and eliminating inefficiencies, and in attaining the highest possible output within the resource endowments.

2 Materials and Methods

2.1 Data and the Study Area

The empirical analysis is based on farm-level cross sectional data collected in 2011 from Shyamnagar upazila in the Satkhira district, in the brackish water area, and Fakirhat upazila in the Bagerhat district, in the freshwater water area of southwestern Bangladesh. Shyamnagar and Fakirhat upazilas were selected because most of the brackish water shrimp and freshwater prawn farms are concentrated in this area, farmers are experienced in shrimp and prawn farming and resources and climatic conditions are favorable for shrimp and prawn farming. The shrimp and prawn farms of the selected region account for the 33% and 15% of total country's shrimp and prawn farms, respectively (DOF, 2012). Three villages from each upazilas were selected on the basis of shrimp and prawn farms concentration. A total of 90 shrimp and 90 prawn farmers (30 farms from each village) were randomly selected. A pre-tested questionnaire was used to collect technical and economic data from the shrimp and prawn farmers, as well as socio-demographic and environmental characteristics.

2.2 Theoretical Model: Stochastic Frontier Model

Farrell (1957) defined technical efficiency as the ratio between inputs per unit of output at the production frontier and inputs per unit of output in the observed case. In a more recent presentation, which is adopted in the present study, technical efficiency of the firm, which produces output y with inputs x is given by y/y*, where y* is the frontier output associated with the level of inputs x (Coelli *et al*., 1998).

Aigner *et al*. (1977) and Meeusen and Van den Broeck (1977) proposed a stochastic frontier production function model with the following structure:

$$L\,n\,Y = f(X_i : \beta) + \varepsilon_i \qquad (1)$$

$$\varepsilon_i = V_i - U_i, \quad I = 1, \ldots, N \qquad (2)$$

where Y denotes production level, X_i is input level and β is a vector of unknown parameters to be estimated. ε_i is the composed error term and f is the Cobb–Douglas function form. V_i are independently and identically distributed random errors, having $N(0, \delta v^2)$ distribution while U_i are non-negative stochastic variables, called technical inefficiency effect, associated with the technical inefficiency of production of farmers involved.

According to Battese and Coelli (1995), technical inefficiency effects are defined by

$$U_i = Z_i\,\delta + W_i\,, \quad i = 1, \ldots, N \qquad (3)$$

where Z_i is a vector of explanatory variables associated with technical inefficiency effects, δ is a vector of unknown parameters to be estimated, W_i are unobservable random variables, which are assumed to be identically distributed, obtained by truncation of the normal distribution with mean zero and unknown variance σ^2, such that U_i are non-negative.

The stochastic frontier production function was estimated through the application of the maximum likelihood approach, using the FRONTIER computer program developed by Coelli (1994). The stochastic frontier technique can only handle one single output. Therefore, the different outputs from shrimp and prawn production were aggregated to a single output using the actual farm gate prices. The following model specifications were used in the analysis:

$$\ln Y_i = \beta_0 + \beta_1 \ln X_{1i} + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + \beta_4 \ln X_{4i} + \beta_5 \ln X_{5i} + \beta_6 \ln X_{6i} + \beta_7 n X_{7i} + v_i - u_i \qquad (4)$$

where,

ln represents the natural logarithm (i.e., to the base *e*) and *i* refers to the i^{th} farm in the sample;

Y_i represents geometric mean based on revenue share of multi-output (such as shrimp/prawn production, other fine fish production, dike crops and rice production) which is an ideal output variable in the production frontier analysis as suggested Iinuma *et al*., 1999;

X_{1i} represents the total area of land/gher[1] size in hectares;

[1] *Gher* is Bengali word used to describe coastal fisheries in the south-western region of Bangladesh. G*her* means encirclement of brackish water areas along the coastal belts by building dwarf earthen dykes in order to hold tidal water containing shrimp fries until they grow to marketable size.

X_{2i} represents the human labor employed in man-days per hectare;
X_{3i} represents total number of shrimp/prawn fingerlings released/stocked per hectare per year;
X_{4i} represents quantity of feeds in kg (pulses, oilcake and wheat bran) applied per hectare per year;
X_{5i} represents quantity of lime applied in kg per hectare per year;
X_{6i} represents quantity of manure/fertilizer used in kg per hectare per year;
X_{7i} represents quantity of pesticide used in kg per hectare per year/amount of cost incurred for other inputs in Taka per hectare per year;
β_1 - β_7 are parameters to be estimated;
v_i represents the random variations in output due to factors outside the control of the farm operator such as: degree of water salinity, shrimp fry availability in the sea water, disease of shrimp, existence of carnivorous (predator) fish species during the entry of sea water in the farms.

Following Battese and Coelli (1995), it is further assumed that the technical inefficiency distribution parameter, U_i is a function of various operational and farm specific variables hypothesized to influence technical inefficiencies as:

$$U_i = \delta_0 + \delta_1 z_{1i} + \delta_2 z_{2i} + \delta_3 z_{3i} + \delta_4 z_{4i} + \delta_5 z_{5i} + \delta_6 z_{6i} + \delta_7 z_{7i} + \delta_8 z_{8i} + \delta_9 z_{9i} \quad (5)$$

where z_{1i} denotes the age of the ith farmer in year;
z_{2i} denotes the education (year of schooling) of the ith farmer;
z_{3i} denotes the training received by the ith farmer (1 if received, 0 otherwise);
z_{4i} denotes the involvement in fish farm associations of ith farmer (1 if involve, 0 otherwise);
z_{5i} denotes share of non-farm income to total income of ith farmer in percent;
z_{6i} denotes the family size of ith farmer in persons;
z_{7i} denotes the distance of the farm from the canal of ith farmer (1 if less than 500 metres, 0 otherwise);
z_{8i} denotes the water quality of gher of ith farmer (1 if good enough, 0 otherwise); and
z_{9i} denotes the proportion of lease area to total shrimp/prawn farm area of ith farmer;
δ_1, δ_2, δ_3, δ_4, δ_5, δ_6, δ_7, δ_8 and δ_9 are unknown parameters to be estimated.

2.3 Sample characteristics

A summary of the sample data from the survey for the variables incorporated in the stochastic frontier model is presented in Table 1. The table shows that considerable variation exists among the farmers in terms of production practices and the socioeconomic attainments. The average gher size of the sampled shrimp farms is 2.0 ha, ranging from 0.53 ha to 6.68 ha, while 28% of operations have a gher size of less than 1.0 ha. The average gher size for the prawn farms is 1.96 ha, ranging from 0.20 ha to 6.32 ha and 30% of the farms have a gher size of less than 1 ha.

Table 1. Summary statistics for variables in the stochastic frontier production functions for shrimp and prawn farmers of different farming types

Variables	Farm types	Sample mean	Standard deviation	Minimum value	Maximum value
Geometric mean of total return (Taka/ha)	Shrimp	16125.68	7728.79	6485.89	44608.69
	Prawn	9133.44	2325.93	4737.19	18206.71
Land (Hectares)	Shrimp	2.00	1.52	0.53	6.68
	Prawn	1.96	1.37	0.20	6.32
Labour (Person-days/ha)	Shrimp	116.79	37.45	35.93	220.45
	Prawn	88.61	22.37	39.58	151.25
Labour (Person-days/ha)	Shrimp	116.79	37.45	35.93	220.45
	Prawn	88.61	22.37	39.58	151.25
Shrimp/Prawn fry/fingerlings (Number/ha)	Shrimp	8034.15	1191.71	4574.07	10977.78
	Prawn	13052.84	677.62	11805.15	14250.00
Feed (kg/ha)	Shrimp	134.55	116.61	0.00	428.13
	Prawn	1086.23	160.15	833.30	1504.00
Lime (kg/ha)	Shrimp	53.13	114.56	0.00	439.95
	Prawn	168.31	74.19	67.33	301.00
Organic fertilizer (kg/ha)	Shrimp	168.49	61.37	44.85	274.44
	Prawn	170.32	72.38	75.74	290.00
Pesticide	Shrimp (kg/ha)	9.56	9.13	0.00	37.05
	Prawn (Other cost Taka)	5638.01	1476.89	3694.44	15607.11
Education (years of schooling)	Shrimp	10.17	3.45	0.00	16.00
	Prawn	11.27	2.09	5.00	16.00
Age (years)	Shrimp	45.36	10.16	25.00	70.00
	Prawn	42.89	6.32	29.00	55.00
Nonfarm income (Taka)	Shrimp	44103.33	35847.67	0.00	150000.00
	Prawn	59455.56	32719.83	12000.00	150000.00
Family size (persons)	Shrimp	5.16	1.39	2.00	10.00
	Prawn	5.16	1.11	3.00	8.00
Proportion of lease area (%)	Shrimp	6.76	19.33	0.00	100.00
	Prawn	7.28	1.55	0.00	81.00

The average gher size of shrimp farming (2.0 ha) is comparatively larger compared with prawn (1.96 ha) farming. Stocking density of shrimp farms on average (number of fingerling released per ha) is appeared to be 8034.15 pieces while stocking density of overall prawn farms is 13052.84 pieces on average, which has considerable variation in the two farm types as prawn farmers used more fingerlings compared with shrimp farmers. The average feed application in shrimps

is 134.55 kg/ha which is higher compare to earlier studies as shrimp is grown naturally without any feed or little feed application. The average feed application in the prawn system is 1086.23 kg/ha. In prawn farming farmers used more feed compared to shrimp. Prawn farmers used more lime (168.31kg/ha) compared with shrimp farmers (53.13 kg/ha). All the sample shrimp and prawn farmers apply organic fertilizer for gher preparation and water treatment which ranges from 44.85 kg/ha to 274.44 kg/ha with a mean of 168.49 kg/ha and from 75.74 kg/ha to 290.00 kg/ha a mean of 170.32 kg/ha, respectively, indicating that farmers of both production systems use almost the same quantity of fertilizer. The mean of nonfarm annual income of the shrimp and prawn farmers are Tk. 44103.33 (US$ 543.48) and Tk. 59455.56 (US$ 732.66) respectively. The average labor use in the shrimp and prawn farming is 116.79 man-days/ha, ranging from 35.93 man-days/ha to 220.45 man-days/ha and 88.61 man-days/ha ranging from 39.58 man-days/ha to 151.25 man-days/ha, respectively. Although intensity of inputs use varies across gher, the overall technology practice is largely improved extensive (33% of sample farmers) (relying more on naturally food produced in the water body and to some degree on supplementary inputs) to semi-intensive (67%, relying mostly on supplementary feed and fertilizer). The average age of farmers vary from 45.36 years in shrimp to 42.89 years in prawn farming. Average general educational level is seemed to be moderate varying from ten years in year round to eleven years in shrimp and prawn farming (Table 1).

3 Empirical Results

3.1 Stochastic Frontier Results

The estimates of the stochastic frontier analysis which shows the best practice performance, i.e., efficient use of the available technology, is presented in Table 2. The empirical results in Table 2 indicate that the output elasticity with respect to gher size in overall shrimp farming was estimated to be -0.281 and is significant at 1% level which is unexpected but might be due to over use of input. This indicates that, if the gher size of shrimp farms is increased by one percent, then the per hectare return from shrimp is estimated to decrease by 0.281%. In the overall shrimp farming the elasticity of output with respect to labor, fingerlings, organic fertilizer and pesticide are estimated to be 0.104, 0.302, 0.149 and 0.063 respectively and statistically significant. The elasticity of output with respect to fingerlings implies that, if the number of shrimp fingerlings is increased by one percent, the shrimp return is estimated to increase by 0.302%. The increase in the use of shrimp fingerling is expected to have a positive effect on shrimp production, unless the quality of fingerling is very poor or diseased.

In the case of prawn farming, elasticity of frontier production with respect to gher size is -0.167 and significant at 1% level. This indicates that if the area under prawn production is to be increased by one percent, the average return from prawn is estimated to decrease by 0.167% which is wondering as land has some impacts on

production. It might be due to over use of inputs of the small farmers and less use of inputs of the large farmers. Further, the elasticity of output with respect to fingerlings, feed, organic fertilizer and pesticide are estimated to be 0.089 and 0.741, 0.297, 0.310, 0.162, respectively, and statistically significant.

Gher size may have some influence on production of output but we encountered a negative sings for gher size both shrimp and prawn farming which are significant. Whether small lands are more productive or not is still dilemma. No definite answer is established as yet. Rahman (2005) found medium sized gher having the highest yield. The small gher get intensively input fed since additional of a small quantity of inputs adds very little to the overall cost that is not usually felt burdened. However, this small addition of inputs might get proportionately higher than the gher requires. It is likely that this might have happened beyond the knowledge of the farmers. On the contrary, larger land owners also seldom add inputs proportionately with the gher size because costs associated with the inputs application for bigger gher are high. Therefore, they are likely to add proportionately less than the gher requires. This feeling often results in proportionately higher input feeding for small ghers and lower for larger ghers. This is general scenario in particularly the shrimp and prawn farming system under the existing economic conditions of the farmers. Appearance of a negative signs for the coefficient of gher is therefore not surprising.

3.2 Factors Explaining Inefficiency

The results indicate that the farm specific variables included in the technical inefficiency model contribute significantly, both as a group and several of them individually, to the explanation of the technical inefficiencies (Table 2). In overall shrimp farming, education of the farmers, training, age and nonfarm income have positive impact on technical efficiency (negative impact on technical inefficiency and involvement in fish farm associations, family size, distance, water quality and lease area have negative impact on technical efficiency (positive impact on technical inefficiency).

Results indicate that education significantly improves technical efficiency of shrimp farming, consistent with Asadullah and Rahman (2009) and Sharif and Dar (1996) for Bangladeshi farms. The educated farmers are expected to follow the shrimp management practices properly, which might have led to higher efficiency for them. The age coefficient is positive and significant with technical efficiency in shrimp farming which indicates that older farmers are more capable to take proper decisions regarding farm management practices as they have many years of practical experience. This confirms to the results obtained by Dey *et al*. (2000); Alam *et al*. (2011) and Rhaman *et al*. (2011).

In the case of prawn farming factors such as nonfarm income, family size and water quality were positively related to inefficiency while education, training, age, involvement of fish farm associations, distance of the farm from the canal, and lease area were negatively related to inefficiency. It is expected that the coefficient of nonfarm income (not significant) to be positive however the findings of this study is consistent with the findings of Haque (2011).

Table 2. Maximum Likelihood estimates of the stochastic frontier production function of the shrimp and Prawn farming

Variables	Parameters	Shrimp		Prawn	
		Coefficients	Standard error	Coefficients	Standard error
Production frontier					
Constant	β_0	6.580***	1.303	12.474***	0.955
Land (x_1)	β_1	-0.281***	0.032	-0.167***	0.047
Labour (x_2)	β_2	0.104*	0.058	0.089	0.081
Fingerlings (x_3)	β_3	0.302**	0.150	0.741***	0.236
Feed (x_4)	β_4	0.004	0.009	0.297	0.258
Lime (x_5)	β_5	0.008	0.009	-0.346**	0.165
Organic fertilizer (x_6)	β_6	0.149***	0.048	0.310**	0.148
Pesticide (x_7)	β_7	0.063***	0.0137	0.162***	0.038
Inefficiency function					
Constant	δ_0	-2.411	3.354	1.748***	0.370
Education	δ_1	-0.166**	0.176	-0.096***	0.026
Training	δ_2	-0.755	0.818	-0.103*	0.119
Age	δ_3	-0.016*	0.014	-0.014*	0.009
Involvement of fish farm association	δ_4	0.561	0.680	-0.015	0.198
Non-farm income	δ_5	-0.005	0.008	0.211	0.918
Family size	δ_6	0.385	0.391	0.021	0.055
Distance	δ_7	0.183	0.306	-0.076	0.237
Water quality	δ_8	0.216*	0.209	0.154*	0.131
Lease area	δ_9	0.008	0.135	-0.129	0.825
Variance parameters					
Sigma-squared	σ^2	0.415	0.470	0.091***	0.011
Gamma	γ	0.975***	0.031	0.999***	0.0006
Log likelihood		37.23		25.73	
Mean TE index		87.84%		72.41	

*** Significant at 1%, ** Significant at 5% and * Significant at 10%

The educated prawn farmers are expected to follow the prawn management practices properly, which might have led to higher efficiency for them. This result is consistent with the findings by Abdulai and Eberlin (2001), which established that an increase in formal education will augment the productivity of farmers since they will be better able to allocate family-supplied and purchased inputs, select and utilize the appropriate quantities of purchased inputs while applying available and acceptable

techniques to achieve the portfolio of household pursuits such as income. The training coefficient is positively significant with technical efficiency in prawn farming, which consistent with Rashid (2002).

It is evident from Table 2 that the estimate of σ^2 and γ are large and significantly different from zero, indicating a good fit and the correctness of the specified distributional assumption. Moreover, the estimate of γ, which is the ratio of the variance of farm-specific technical efficiency to the total variance of output, is 0.98 of shrimp; and significant at 1% level. In the case of overall prawn farming the γ-parameter associated with the variances in the stochastic production frontier is estimated to be close to 1 (Table 2). This suggests that the technical inefficiency effects are significant component of the total variability of shrimp output for different farming methods. Therefore, the traditional production function with no technical inefficiency effects is not an adequate representation of the data.

3.3 Efficiency Distribution

The mean technical efficiency of the shrimp farmers in Bangladesh is 88±9% (Mean ± Standard deviation), ranging from 52% to 97% (Table 3). And the mean technical efficiency of the prawn farmers in Bangladesh is 72.41±16% ranging from 39.56% to 99.79%. The implication is that, on average, shrimp and prawn farming could generate 12% and 25% higher output, respectively by eliminating technical inefficiency, which is substantial and could improve the competitiveness of the Bangladesh shrimp and prawn farming. The indices of TE indicate that if the average shrimp farmers of the sample could achieve the TE level of its most efficient counterpart, then average shrimp farmers could increase their return by 9% [1-(88/97)].

On the other hand, the indices of TE indicate that if the average prawn farmers of the sample could achieve the TE level of its most efficient counterpart, then average prawn farmers could increase their return by 27% [1-(72/99)]. Similarly, the most technically inefficient prawn farmers could increase the return by 60% [1-(40/99)] if he/she could increase the level of TE to his/her most efficient counterpart. Similarly, the most technically inefficient shrimp farmers could increase the return by 46.39% [1-(52/97)] if he/she could increase the level of TE to his/her most efficient counterpart. For a land-scarce country like Bangladesh, these gains in return will increase their overall income and ensure better livelihood for the farmers. The distributions of the efficiency scores are quite similar at the higher of the efficiency spectrum for farm types. About 4.44% of the shrimp farmers respectively are producing at an efficiency level of less than 60% while 57.78% of the shrimp farmers are producing respectively at an efficiency level of 90% and above, which are encouraging (Table 3). About 8.89% of the prawn farmers are producing at an efficiency level of less than 50% while 15.56% of the prawn farmers are producing at an efficiency level of 90% and above.

The mean technical efficiency of shrimp and prawn farms is 87.84% and 72.41% respectively, which is quite similar to the estimates of average agricultural farms (aquaculture and livestock/dairy farms) in Bangladesh and/or elsewhere in the world (Bravo-Ureta *et al.,* 2007; Coelli *et al*., 2002; Wadud and White, 2000, Theodoridis

et al., 2009; Theodoridis *et al*., 2011). Haque (2011) found the TE of shrimp culture to be 71%. Rashid (2002) found technical efficiency of extensive, improved extensive and semi intensive shrimp farming were 82%, 85%, 93% respectively. However, technical efficiency of shrimp farming in other countries appeared to be higher than that found in Bangladesh. Studies on India conducted by Reddy *et al*. (2008) estimated the TE of shrimp to be 93%. Other studies such as Alam *et al*. (2011) found the TE of tilapia in Bangladesh farmers at 78%. Sharma and Leung (2000) estimated the TE of carp polyculture in Bangladesh to be 47.5% for extensive farming and 73.8% for semi-intensive farming. ICLARM (2001) found the TE of carp polyculture at 70%. This wide inefficiency spectrum is not surprising and is similar to those reported in the literature (Rahman *et al*., 2011; Alam *et al*., 2011; Bravo-Ureta *et al*., 2007; Coelli *et al*., 2002; Wadud and White, 2000).

3.4 Tests of Hypotheses

A likelihood ratio test was conducted to test the null hypothesis that the Cobb-Douglas production function could be replaced by the translog production function. The test statistic H_0: $\beta_{jk} = 0$, H_1: $\beta_{jk} \neq 0$, has a likelihood ratio value of 12.21 for shrimp and 9.35 for prawn farms, implies a rejection of the null hypothesis at the 5% significance level. In other words, the Cobb-Douglas production function is more suitable to the shrimp and prawn farms survey data that adequately captures the production behaviour.

Now we turn our attention to the tests of hypotheses for the study. Hypothesis (1): the inefficiency effects are not present, symbolically,

$$H_0: \gamma = \delta_0 = \delta_1 = \delta_2 = \ldots\ldots\ldots = \delta_9 = 0; \text{ and}$$

hypothesis (2): the coefficients of the explanatory variables in the inefficiency model are equal to zero (and hence that the technical inefficiency effects have the same truncated-normal distribution) i.e.,

$$H_0: \delta_1 = \delta_2 = \ldots\ldots\ldots = \delta_9 = 0$$

were tested using the generalized likelihood-ratio statistic, λ, defined by Equation 5. Formal tests of hypotheses associated with the inefficiency effects (hypotheses (1) and (2)) are presented in Table 4. It is evident from Table 4 that the null hypothesis H_0: $\gamma = \delta_0 = \ldots = \delta_9 = 0$ is rejected for the shrimp and prawn farming indicating the significant presence of inefficiency effects on shrimp and prawn farming. Thus the traditional average response function is not an adequate representation for shrimp and prawn production, given the specification of the stochastic frontier and inefficiency model, defined by Equations (3) and (4).

The second null hypothesis H_0: $\delta_1 = \delta_2 = \ldots\ldots\ldots = \delta_9 = 0$ implies that technical inefficiency effects follow a standard truncated normal distribution (Stevenson, 1980) as the null hypothesis is rejected at 5% level of significance for both categories of farming. This indicates that the farm-specific variables involved in the technical inefficiency model contribute significantly as a group to the explanation of the

technical inefficiency effects in shrimp and prawn production although, based on asymptotic t ratios, some slope coefficients are not significant individually.

Table 3. Distribution of technical efficiency scores

Variables	Estimates	
	Percent	
Efficiency levels	Shrimp	Prawn
≤ 50	0.00	8.89
50 ≤ 60	4.44	11.11
60 ≤ 70	3.33	30.00
70 ≤ 80	3.33	13.33
80 ≤ 90	31.11	21.11
90 ≤ 100	57.78	15.56
Mean efficiency level	0.88	0.72
Minimum	0.52	0.4
Maximum	0.97	0.99
Standard deviation	0.09	0.16
Number of observations	90	90

Table 4. Generalized likelihood ratio tests of hypotheses of parameters

Test of null hypotheses (H_0)	Log-likelihood value of the reduced model	Test statistic (λ)	DF	Critical χ^2 value at 95%	Conclusion
1. No inefficiency effects (H_0: $\gamma = \delta_0 = \delta_{Ed} = \ldots. = \delta_{Fs} = 0$)					
Shrimp farming	27.26	19.95	11	19.045	Reject H_0
Prawn farming	13.34	24.83	11	19.045	Reject H_0
2. No effects of inefficiency factors included in the inefficiency model (H_0: $\delta_{Ed} = \ldots. = \delta_{Fs} = 0$)					
Shrimp farming	27.22	20.02	9	16.274	Reject H_0
Prawn farming	13.29	24.88	9	16.274	Reject H_0

Note: The value of the log-likelihood function under the specification of alternative hypothesis (unrestricted/full model) is 53.89. The correct value for the null hypothesis of no inefficiency effects are obtained from Kode and Palm (1986).

The next issue of interest is to test the hypothesis (3): shrimp farms are equally technical efficient with prawn farming operating under different farming types. A simple t-test was administered for testing this hypothesis. Assuming H_o to be true, the hypothesis can be written as, technical efficiency of shrimp farms = technical efficiency of prawn farms;
H_1 : H_o is not true.

Formal test of hypothesis (3) associated with the technical efficiency of farms is presented in Table 5. The null hypotheses considered in Table 5, $H_o: TE_{(sh)} = TE_{(pr)}$ is rejected at 1% level of significance which indicated that there are evidence that the mean of technical efficiency is significantly different.

Table 5. Statistics for test of hypothesis involving technical efficiency of the shrimp and prawn farms types

Null Hypothesis	Test Statistic t	Critical Value (5%)	Decision
$H_o: TE_{(sh)} = TE_{(pr)}$	7.870	1.654	Reject H_o

Note: sh = shrimp, pr = prawn.

4 Conclusions and Policy Implications

This study examines the efficiency of shrimp and prawn farming in Bangladesh. The production data and several farm-specific data were collected from a sample of shrimp and prawn farmers and analyzed using a stochastic production frontier, including a model for the technical inefficiency effects. The parameters for the production frontier and those for the technical inefficiency model are estimated simultaneously using a ML estimation technique. The results indicate that there are significant production inefficiencies among the sample shrimp and prawn farmers in Bangladesh. The mean technical efficiency level of shrimp and prawn farming were 88% and 72% respectively implying that a substantial 18% and 28% of the potential output from the shrimp and prawn farming system can be recovered by eliminating inefficiency. Reductions in technical inefficiencies are unlikely to bring about large productivity gains. Our estimates suggest that these efficiency gains could mainly come from increased production intensity, from the improvement in the adoption of management practices, and from making better use of other inputs. The key factors of the management practices of brackish water shrimp and fresh water prawn farming in Bangladesh are to be considered by farmers as feeding show improper application. The quality, quantity of feeds, and frequency of feeding are important considerations in shrimp and prawn farming management, which will enhance the productivity of shrimp and prawn farming. In addition, fingerlings, fertilizer and pesticides are significant factors contributing positively to the production of shrimp and prawn. Finally, education, age of farmers, and water quality, are significant determinants of technical inefficiency of shrimp and prawn farming. The study reveals that the level of understanding of shrimp/ prawn farming technology is different across farmers, particularly in terms of inputs application. The decision to add or not to add inputs must be reasoned. It has to be judicious and this could help farmers to increase their farm efficiency. Policies leading to the improvement of farm education would be favourable for improving the technical efficiency of farmers. More investment in education in rural areas through private and public partnerships, initiating progress to encourage those at school-going age and ‘food for education’ programs may be harnessed as a central ingredient in the development strategies. Moreover, the farmer field schools (FFS) program, promoted by different development agencies may be

rigorously implemented and practiced. This would help farmers develop their 'learning by doing' practices and improve their analytical and decision-making skills that contribute to adapting improved farming technologies. These measures in the long run may shift the farmers' production frontier upward, which may in turn, reduce technical inefficiency on the one hand and lead to raise income and standard of living of the farming people on the other.

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Influence of Sublethal Lead Concentrations on Glucose, Serum Enzymes and Ion Levels in Tilapia (Oreochromis mossambicus)

Hasan Kaya[1], Mehmet Akbulut[2], Sevdan Yılmaz[3]

[1]Çanakkale Onsekiz Mart University, Marine Sciences and Technology Faculty, Department of Basic Sciences, Çanakkale-Turkey, e-mail: hasankaya@comu.edu.tr
[2]Çanakkale Onsekiz Mart University, Marine Sciences and Technology Faculty, Department of Basic Sciences, Çanakkale-Turkey, e-mail: mehakbulut@comu.edu.tr
[3]Çanakkale Onsekiz Mart University, Marine Sciences and Technology Faculty, Department of Aquaculture, Çanakkale-Turkey, e-mail: sevdanyilmaz@comu.edu.tr

Abstract. In this study, alterations in glucose, blood enzymes (alkaline phosphatase (ALP), lactate dehydrogenase (LDH), alanine transaminase (ALT), aspartate aminotransferase (AST)) and serum ion (P^{+++}, Mg^{+}, Cl^{-}, Ca^{++}, Fe^{++}) levels were investigated in Tilapia (*Oreochromis mossambicus*), which were semi-statically exposed to different lead concentrations *in vivo*. The fish were exposed to low (0.5 mg/L), medium (2.5 mg/L) and high (5 mg/L) concentrations of lead during 14 days. At the end of the experiment, biochemical blood parameters such as glucose, ALP, LDH, AST, chloride and magnesium increased ($p<0.05$). While, LDL and calcium levels decreased ($p<0.05$); ALT, cholesterol, albumin, iron and phosphor were fluctuated ($p<0.05$). Consequently, it was found that exposure of *O. mossambicus* to lead concentrations affected serum biochemical parameters negatively.

Keywords: lead, toxicity, glucose, serum enzymes, ion levels, *Oreochromis mossambicus*

1 Introduction

Lead is a persistent contaminant in the natural environment that can enter the water column through geologic weathering and volcanic action, or by various anthropogenic activities including mining and smelting of lead-ores, burning of coal, effluents from storage battery industries, automobile exhausts, metal coating and finishing operations, fertilizers, pesticides and from additives in pigments and gasoline (WHO, 1995).

Contamination of water through anthropogenic practices is the primary cause of lead poisoning in fish (Sorensen, 1991). Due to its nondegredable nature, it's get into the environment and eventually enters to fish and human body system. When it can enter to the body lead can accumulate to soft tissues such as liver, kidney, nervous system and brain of fish (Berman, 1980). It is well documented that lead can impair

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the health of humans and other organisms by neurotoxicity, renal toxicity, and deleterious effects on the hematological and cardiovascular systems (ATSDR, 2006). In studies examining the toxicity of lead on fish, it was determined that lead inhibited to Na^+, K^+-ATPase enzyme activity and caused to oxidative stress in tilapia (Kaya and Akbulut, 2015), it damage Ca^{2+} and Na^+ homeostasis in trout fish at concentrations found in ecosystems (Rogers et al. 2003; Patel et al. 2006), and caused hematological (Kaya et al. 2013) and neurological (Davies et al. 1976) effects in fish under chronic conditions. However, no studies evaluating the effects of sublethal lead concentrations on the biochemical parameters of fish could be found.

The present study aimed to investigate the effects of water-borne lead on fish with special reference to the blood glucose, serum enzymes and ions.

2 Material and Methods

2.1 Experimental design

Tilapia fish used in this study (n=144) were obtained from Çanakkale Onsekiz Mart University (Marine Sciences and Technology Faculty, Aquaculture Department), Çanakkale, Turkey, and were adapted to ambient conditions in 12 stock aquariums, each with dimensions of 45x28x80 cm and containing 80 L of rested, Çanakkale city tap water, for 4 weeks. Fish weighting 45.2±5 g (mean±SD) were divided into 12 experimental aquariums, each containing 12 fish, and an experimental design with three replicates was established. Feeding was interrupted 24 h before the start of the experiments to help maintain water quality. During the experiment, the fish were fed twice a day with feed at about 2% of their body weight and their behavior was observed during each feeding. Care was also taken to ensure that all of the feed added to the tanks was eaten and that fecal waste was quickly removed from the tanks at every water change. In the experiment, fish were exposed to the following sublethal concentrations of lead: low, 0.5 mg/L; medium, 2.5 mg/L; and high, 5 mg/L. The control group was maintained in freshwater only. Concentrations were determined by considering in Ay et al. (1999). The experiment had a semi-static regime, and water was changed every day: a 75% change in the morning and a 25% change in the evening (modified from Smith et al. 2007). After each water parameters were as follows: temperature, 25.4±0.3°C (mean±SE); dissolved oxygen, 6.31±0.11 mg/L; pH, 7.15±0.04; hardness, 125.0±6.2 mg/L $CaCO_3$; total ammonia, 0.151±0.02 mg/L. The electrolyte composition of the dechlorinated Çanakkale tap water was measured as 0.310±0.005, 0.049±0.001, 0.534±0.001, and 0.828±0.006 mmol/L for Na^+, K^+, Mg^+, and Ca^{2+}, respectively. Fish were randomly sampled on days 0, 7, and 14 for blood biochemistry analysis. The experiments were performed in accordance with the guidelines for fish research established by the Animal Ethics Committee at Çanakkale Onsekiz Mart University.

2.2 Preparation of the $Pb(NO_3)_2$ Solution and Application

The heavy metal salt, $Pb(NO_3)_2$ (99.5% purity; Sigma-Aldrich, Steinheim, Germany), was used in the experiment. To obtain the needed concentrations, the main stock solution was prepared in ultra-distilled water and appropriate dilutions made from it.

2.3 Blood Sampling

In the experiment, total 12 fish on the first day (from the stock aquarium), 6 fish from each aquarium on the 7^{th} and 14^{th} day were used for blood analysis. For blood sampling, fish were anaesthetized with MS222 (Smith et al. 2007). They were well wiped and cleaned in order to avoid mucus mixing into the blood, and then, blood was taken from the fish through the caudal vein by a 5 ml plastic syringe, without harming the fish (Val et al. 1998). Then, a sample of blood was transferred to EDTA tubes, BD Microtainer®, UK for hematological analysis. Plastic biochemistry tubes (Kima-vacutest®, Italy) were used for biochemical analysis. Blood serum was isolated by centrifugation (4000xg, 10 min) and it was stored below -20°C.

2.4 Biochemical Analysis

For biochemical analysis, the blood collected was centrifuged at 4000 rpm for 10 minutes and blood serum was separated (Bricknell et al. 1999). Then, the serum extracted was analyzed on the spectrophotometer (T80+UV/VIS) using an analyzer (Bioanalytic Diagnostic Industry, Co). The biochemical parameters that were detected during the test included glucose (GLU), alkaline phosphatase (ALP), aspartate aminotransferase (AST), alanine aminotransferase (ALT), lactate dehydrogenase (LDH), calcium (Ca^{2+}), magnesium (Mg^{+}), iron (Fe^{++}), phosphorus (P^{+++}) and chlorine (Cl^{-}).

2.5 Statistical analysis

ANOVA with Dunnett post-test (one-way ANOVA for comparison between exposure groups and control group) was used. The statistical analysis was made by using SPSS 17.0, and the significance level was considered to be 0.05 (Logan, 2010).

3 Results

Glucose and serum enzymes obtained from the study were given in Table 1.While the glucose levels registered an increase in medium and high concentrations on 7^{th} and 14^{th} days compared to the control group, they did not show any differences with the control group in low concentrations. While the ALP increased across all groups on day 7 compared to the control group, on day 14, the low and medium

concentrations registered an increase. The enzyme AST was revealed to be high across all groups on day 7 and on day 14, it was found out to be higher in low and medium concentrations compared to control group. While the ALT activity was revealed to be lower on day 7 compared to control group, on day 14, a decrease in low and medium dose was determined compared to the control group as an increase in high group was experienced. While the enzyme LDH showed similarities with control group in every group, ($p>0.05$), it increased across all groups on day 14.

Serum electrolytes during the study are given in Table 1. While the Ca^{2+}, one of the serum ions of the study decreased on days 7 and 14 across all groups compared to control group, the Mg^{+} increased in medium and high concentrations on day 7. On the other hand, while Fe^{++} showed a decrease in low and high doses on day 7 compared to control group, the medium dose increased. On day 14; a decrease compared to the control group in low and medium doses was determined while an increase was registered in high doses. The Cl^{-} electrolyte showed an increase on days 7 and 14 across all groups compared to the control group. P^{+++} on the other hand, showed an increase in low and high concentrations on day 7 and showed a decrease on day 14 in high group compared to the control group.

Table 1. Effects of different concentrations of lead on glucose, serum enzymes and some serum minerals. Exposure groups are represented as follows control: 0 (Control), low (0.5 mg/L), medium (2.5 mg/L), high (5 mg/L); ALP, alkaline phosphatase; AST, aspartate aminotransferase; ALT, alanine aminotransferase; LDH, lactate dehydrogenase, Ca^{2+}, calcium; Mg^{+}, magnesium; Cl^{-}, chloride; Fe^{++}, iron; P^{+++}, phosphor. The differences among the times shown with the small letters for each ion are significant ($p<0.05$).

		GLU (mg/dL)	**ALP (U/L)**	**AST (U/L)**	**ALT (U/L)**	**LDH (U/L)**	**Ca^{2+} (mmol/L)**	**Mg^{+} (mmol/L)**	**Fe^{++} (µg/dL)**	**Cl^{-} (mmol/L)**	**P^{+++} (mmol/L)**
	Initial	172.044±0.78	5.13±0.26	6.33±0.87	16.71±2.01	58.22±2.93	10.621±0.50	3.026±0.05	79.681±0.8	162.035±4.67	5.281±0.43
Control	**7th day**	167.199±4.10^{c}	5.73±0.77^{d}	6.52±0.44^{c}	16.58±0.66^{a}	61.17±4.19	10.599±0.39^{a}	3.006±0.18^{b}	77.134±1.58^{b}	163.107±6.62^{c}	5.371±0.20^{b}
Low		182.484±4.98^{c}	9.52±0.47^{c}	6.56±0.12^{c}	13.05±0.77^{ab}	73.17±2.70	9.149±0.37^{b}	3.130±0.03^{b}	61.087±1.36^{c}	345.095±4.68^{b}	7.607±0.52^{a}
Medium		215.884±7.68^{b}	18.76±1.7^{a}	18.21±0.99^{b}	13.26±1.39^{ab}	74.38±3.02	7.391±0.16^{c}	3.583±0.11^{a}	129.717±2.8^{a}	379.362±2.58^{a}	6.044±0.19^{b}
High		271.954±2.80^{a}	13.41±0.87^{b}	38.15±1.6^{a}	9.34±0.75^{b}	85.29±2.77	8.186±0.27^{bc}	3.707±0.06^{a}	59.148±1.31^{c}	390.79±6.63^{a}	8.366±0.43^{a}
Control	**14th day**	172.900±2.60^{c}	5.89±0.72^{b}	6.80±0.60^{d}	17.88±1.46^{b}	54.27±3.03^{b}	10.373±0.28^{a}	3.258±0.07^{ab}	78.374±2.66^{b}	170.763±8.04^{c}	5.642±0.58^{a}
Low		182.424±5.91^{c}	10.19±1.12^{a}	21.81±2.86^{b}	2.12±0.15^{c}	145.03±4.21^{a}	9.616±0.20^{a}	3.473±0.05^{a}	58.289±0.86^{c}	161.338±4.68^{c}	6.459±0.37^{a}
Medium		206.338±7.67^{b}	8.90±0.77^{a}	14.86±1.05^{c}	7.50±0.61^{c}	163.30±5.60^{a}	6.080±0.007^{c}	2.962±0.12^{b}	61.463±0.94^{c}	392.107±6.68^{a}	5.874±0.13^{a}
High		229.235±5.94^{a}	3.13±0.19^{b}	85.48±2.78^{a}	27.77±1.61^{a}	142.41±3.24^{a}	7.638±0.007^{b}	2.924±0.02^{b}	97.392±3.31^{a}	346.97±1.26^{b}	3.961±0.10^{b}

4 Discussion

The glucose is the primal source of the energy that is required for the vital actions and its level in serum is regulated through the endocrine system (Dange, 1986). In fish, in addition to the stress induce such as hunger, dense stocking etc; the pollutants such as metals also increase the secretion of the cortisol, epinephrine and glucocorticoid thus leading to the changes in carbohydrate metabolism (Sastry and Subhadra, 1985). Under the influence of lead metal and the environmental concentrations, it was revealed that the glucose levels in serum increased compared to the control group. It is thought that such an increase forms hyperglycemia and in addition, leads to damages in liver and hormonal irregularities (insulin deficiency).

The enzymes of dehydrogenize and phosphatase are important and critical enzymes in terms of biological processes and thus they are responsible for the detoxification and biosynthesis of macro molecules (Yousef et al. 2007). In tilapia; increases in LDH and ALP activities (both are blood serum enzymes) indicate that liver damage due to the presence of lead metal. The increases are thought to be occurring due to the fact that as the result of the liver damage, the liver cytoplasm leaks into the blood stream (Wang and Zhai, 1988). Rahman et al. (2000) reported that in fish that were exposed to the pollutants, the increase results from the LDH enzyme, mixing into blood due to the necrosis in liver. The transaminase enzymes such as ALT and AST play an important role in the metabolism of protein and amino acids. In this study, while the AST activity was found out to be increasing in all concentrations, time and concentration varied increases and decreases were registered in ALT enzyme activity. It is thought that the increases in such enzyme activities are resulted after the enzymes are introduced to the circulatory system due to the damages in liver tissue. ALT, AST, ALP and LDH serum enzymes that were assessed within the scope of this study are prone to be used as sensitive biomarkers in ecotoxicological studies because of their characteristic of being an early warning mechanism against the heavy metal based pollution in aquatic ecosystems (Vaglio and Landriscina, 1999).

The aquatic organisms have to preserve the osmotic pressure of the plasma in order to survive the ever changing environmental conditions and to maintain the water and ion homeostasis. In bony fish, there are advanced structures to provide the aforementioned regulations and such structures keep the inorganic ion concentrations of the fish in close levels. The changes that may occur in electrolyte levels may induce stress and thus may lead to the damages (Sjöbeck and Larsson, 1979). Calcium is an ion that has various roles in ion regulation, membrane permeability, muscle and neuron cell functions and skeletal bone metabolism and in the blood clotting. The most important serum electrolyte for the lead toxicity is calcium. In this study, the calcium levels of tilapia fish that were subjected to lead concentrations were observed to be lower compared to the control group. Such decreases are found out to be consistent with the literature and the decreases in blood calcium levels (hypocalcaemia) was observed. In this study, unlike the calcium ions, increases were revealed in magnesium electrolyte under the impact of lead. The previous study

indicates an inverse relationship between calcium and magnesium ions (Marshall, 2002). Chloride plays an important role in osmotic pressure and ion balance as well as in acid–base equilibrium. In this study, under the effect of water-borne lead concentrations, CI^- ion levels of experimental groups registered increases compared to the control group. Na^+ and Cl^- levels in fish are responsible for the osmolarity. Changes in such ions may cause increase in gill permeability and damages to osmoregulation. It is known that in some studies, under the effect of the pollutants, the inhibitions that occur in the gill Na^+, K^+-ATPase enzyme activity lead to the disarray in ion regulation (Haux and Larsson, 1979).
The changes in parameters that were examined within the scope of this study such as glucose, LDH, ALP, ALT and AST showed that sublethal lead concentrations inflict damage to the liver as the changes in magnesium; calcium and chloride indicate gill damages.

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Crayfish Cultivation in Turkey: Past, Present and Future

Selçuk Türel[1], Semih Kale[2], Selçuk Berber[3]

[1]Department of Basic Sciences, Faculty of Marine Sciences and Technology, University of Çanakkale Onsekiz Mart, Çanakkale, Turkey, e-mail: selcukturel@comu.edu.tr
[2]Department of Fishing and Fish Processing Technology, Faculty of Marine Sciences and Technology, University of Çanakkale Onsekiz Mart, Çanakkale, Turkey, e-mail: semihkale@comu.edu.tr
[3]Department of Basic Sciences, Faculty of Marine Sciences and Technology, University of Çanakkale Onsekiz Mart, Çanakkale, Turkey, e-mail: selcukberber@comu.edu.tr

Abstract. As one of the members of the economic crustaceans; the freshwater lobsters or as they are commonly known as crayfish in Turkey, belong to the Decapoda order of Crustacea class from the phylum of Arthropoda. The freshwater lobsters, which have over 640 species in the world, are generally distributed to the continents of America and Australia. Although the freshwater lobsters have an abundant number of species, the economic importance lies with 3 family (Astacidae, Cambaridae, Parastacidae) and around 10 species from those indicated families. The freshwater lobsters in Turkey are represented by two species. *Astacus leptodactylus*, one of the species is a local one that is abundant around inland water localities while the other species is *Austropotamobius torrentium* whose existence was determined especially in Thrace area within Marmara Region. However, the production of crayfish in our country is practiced only by the means of fishing and the hunted crayfish are imported to various European countries. However, the crayfish cultivation has a great potential in Turkey due to the facts that Turkey is rich in terms of inland waters and the crayfish may be found in various localities.

Keywords: *Astacus leptodactylus,* Crayfish, Turkey.

1 Introduction

The production of freshwater crayfish (*Astacus leptodactylus* Eschscholtz, 1823) (**Fig 1)** began from the mid 1960's around the lakes of Manyas and Uluabat in Turkey (Erençin and Köksal, 1977). The gradually increased production reached to 8000 tons in 1984. Although the production totals showed an increase in later periods, such figures never reached to the levels between 1978 and 1985. Between those years, Turkey became the dominant figure over %70 of the world crayfish market. However, after those years, due to the crayfish plague (fungal disease) and the excessive fishing lead to a serious decline in the production of crayfish (Fürst and Söderhaäll, 1987; Timur and Timur, 1988; Baran and Soylu, 1989). This disease first

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appeared in Turkey within the crayfish stocks in Lake Çivril around the end of 1984 and over time, spread to the lakes of Eğirdir, Beyşehir, Akşehir, Marmara, Apolyont, Manyas, İznik and Sapanca (Timur and Timur, 1988; Baran et al., 1989; Baran and Soylu, 1989). It is thought that the transportation of fishing materials between lakes, transportation of live fish and the migratory birds played an important role regarding the fact that the disease spread to high numbers of water sources in a short period of time (Müller, 1973; Brinck, 1988). In the subsequent years, serious problems were experienced in crayfish stocks and in some localities, the crayfish stocks went to the brink of depletion.

Fig 1. Adult individuals of crayfish (*Astacus leptodactylus*) (Individual on the left is male and on the right is female with eggs).

The crayfish is able live in many water sources, lakes and rivers being first. They are especially found in shallow waters and areas with rocky floor that contains an abundant amount of plantation (Alpbaz, 2005). The crayfish, which use such environments as shelters, became protected from the adverse environmental conditions and especially from the predation and cannibalism. The crayfish are classified as herbivores, detrivores, omnivores and sometimes as a necessity, carnivores (Momot, 1995). The crayfish carry out their life by consuming live or decomposed plants, grains, algae and consuming the remains of thousands of animals ranging from smaller invertebrates to some vertebrate species such as small fish (James and Huner, 1985). In addition, the animal based zooplankton, worms, insects and mollusks may also be the prey of the crayfish.

The production of crayfish in Turkey is only achieved through fishing. In the inland waters of Turkey, the existence of the freshwater lobster has confirmed in 112 localities. Unfortunately, the consumption of crayfish as a food is quite low in Turkey although it is in demand in touristic regions. The crayfish that is produced in Turkey is exported to various European nations such as France and Sweden (TÜİK, 2013) (**Table 1Table 1.** The total exported amounts of the freshwater crayfish (*Astacus leptodactylus*) from Turkey to Europe.).

Table 1. The total exported amounts of the freshwater crayfish (*Astacus leptodactylus*) from Turkey to Europe.

Year	Amount (tons)	Year	Amount (tons)
2001	1634	2008	783
2002	1984	2009	734
2003	2183	2010	1030
2004	2317	2011	610
2005	809	2012	492
2006	797	2013	532.1
2007	816		

Nowadays, the crayfish cultivation in Turkey is mainly limited with the cultivation trials, conducted at universities. In many countries in the word, especially in northern America, China and Australia, the cultivation of crayfish is undertaken. Even by setting up crayfish - rice alternating systems high profits are obtained after receiving the yield of two different products.

Due to the facts that Turkey is rich of inland waters and the crayfish can be found in most of the inland waters, its cultivation can be undertaken with less of a cost compared to the other sea and inland species that are being cultivated. Especially for the crayfish - rice alternating cultivation system, the inland water areas and the paddy fields are highly convenient. Berber et al. (2014) conducted a study in Mahmudiye area (Çanakkale, Turkey) and tracked the rate of survival and growth of the crayfish larvae (initial size: 11.08 mm and initial weight: 0.04±0.01 gr) that they placed to a paddy field for 90 days without any external feeding. As the result, after 90 days, the length of the individuals reached to 37.46 mm and the weight of the individuals reached to 1.46±0.863 gr. The results of the study indicate that the crayfish - rice alternating cultivation method, which is currently employed by many countries, can also be employed in Turkey with ease as well.

2 Results

As the result of the ever increasing world population, the need for nutrient elements, the animal proteins being first, also increase day by day. Crayfish stands as an alternative species compared to many species due to the fats that it is found in many inland waters in Turkey and its nutrient content. In addition to all else, the crayfish cultivation can also be achieved with less costs compared to other cultivated species. There is no need for high cost bearing expenses such as forage. Therefore, its cultivation does not require a serious cost. The rich inland waters of our country have a high potential for employing crayfish cultivation.

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Antecedents and Consequences of Consumer's Dissatisfaction of Agro-food Products and Their Complaining through Electronic Means

Costas Assimakopoulos[1]

[1]Department of Business Administration, Alexander Technological Educational Institute of Thessaloniki, Greece, e-mail: casim@mkt.teithe.gr

Abstract. In this study the antecedents and the consequences of agro-food products consumers' dissatisfaction is studied. Particularly, the main reasons for triggering dissatisfaction are identified and ranked. Moreover, the consumers complaining behavior is also studied and the level of e-complaining adoption is investigated. Additionally, consumers future intentions to complain traditionally or electronically is depicted. Finally, correlations of their complaining behavior and intention to some demographics are found and commented.

Keywords: consumers' satisfaction, Agro-food products, complaining behavior, electronic means

1 Introduction

The rapid development of the Internet and e-commerce has brought changes in the marketplace. Online communities gain importance over their traditional counterparts. Online portals allow individuals to purchase books, movie tickets, and music CDs as well as hospitality services. Consumers make purchase decisions based on other customers' opinions on the Internet.

Especially, for tourism businesses, the Internet offers the potential to make information and booking facilities available to a large number of tourists at relatively low costs. Many social media Websites provide online platforms within which consumers communicate with others who have information or previous experience about products and services. In this context, online reviews play a key role in buying products and thus, social networking websites traffic has increased (Mauri & Minazzi, 2013). These reviews provide customers experience and offer recommendations to potential customers. This phenomenon is quite strong in the hotel industry, where Gretzel (2006) stresses that 77,9% of online users is affected in deciding "where to stay" based on online reviews. However, in areas like agro-food products is not developed at all.

Effective analysis of online customer comments and especially of negative comments, originating from third parties, is needed through organized service

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recovery approaches. The marketing variables entailed in third party websites are usually those that have to do with product's quality, price, etc.

Furthermore, companies should entail the customer complaining behavior variables in their IT systems and, especially, in the CRM software and store data originating from third party reputation systems. This is exactly the aim of this paper. In such a way, the CRM system will be provided with a large collection of online customer reviews and more reliable information will be available to hotel managers.

Based on the previous thoughts and the literature review, which is presented later, this paper attempts to investigate the consumer's dissatisfaction related to agro-food products and the attitude, behavior and intention of the consumer regarding his/her complaining reaction. Particularly, the objectives of the paper are:

To investigate the profile of the sample of the research

To investigate the reasons that contribute to the consumer's dissatisfaction

To investigate their complaining behavior

To investigate their complaining intention

To investigate whether the consumer's characteristics are related to the degree of the consumer's complaining reaction

To investigate if electronic means are used and in what degree to express complaining for agro-food products

The rest of the paper is organized as follows. In section 2 the literature review is made. In section 3 the methodology followed is described. In section 4 results are presented and in the last section some conclusions are given.

2 Literature Review

The key-point for a company is to develop a management philosophy and a strategy which enables it to optimize revenue and increase customer value through understanding and satisfying the individuals customers' needs (Liu, 2007). Individual customer satisfaction is vital for a company. Relationship marketing is at the core of customer –centric orientation. When a firm adopts customer-centric orientation, and therefore exercises relationship marketing, it is attempting to develop and establish long-term relationships with customers. Hence, it is aiming at improved customer service and satisfaction, thus, retaining and further increasing the sales level (Sarmaniotis and Stefanou, 2005). However, customer relationship management (CRM) goes a step further. CRM has been defined as a management approach that involves identifying, attracting, developing and maintaining successful customer relationships over time in order to increase satisfaction, loyalty and retention of profitable customers (Bradshaw and Brash 2001, Massey et al., 2001). In addition, Fjermestad and Romano (2003) maintained and most of the authors and the practitioners accepted that successful CRM requires attracting and keeping economically valuable customers while repelling and eliminating economically invaluable ones.

All companies are positive and in fact wants to collect information about their customers. The point is the ability of the companies to facilitate the collection of, and access to, customer information and further to exploit data mining methods

Obviously data collection and maintenance has been identified as a critical component of a company to enhance its relationships with the customers. Unfortunately, it appears that there has been little consideration of the impact could have variables such as complaining behavior, satisfaction/dissatisfaction, behavioral loyalty including volume and frequency of purchase over time, on a company's strategy. Even though, many studies in marketing field and CRM in particular have shown that customer satisfaction is a critical point in achieving and retaining a competitive advantage and can lead to brand loyalty, repurchase intention and repeat sales (Oliver, 1999; Parasuraman and Grewal, 2000; Stefanou et al., 2003) and finally to customer retention, instead emphasis has been given in acquiring additional customers by a lot of companies.

Moreover, it should be noted that customer complaining is strongly related to the notion of customer dissatisfaction. Customers usually have some expectations about a product or service and when their expectations are not met they feel dissatisfaction which might lead to the adoption of one or more types of complaining behavior (Stefanou et al. ,2003). Particularly, it can be mentioned as an example that in the hotel industry, it is very essential for hotel management to write down customer's complaining behavior, in order to respond in such a way that dissatisfaction is reduced and repeat business is encouraged (Nyer, 2000, Zineldin, 2006). Therefore, consumers' complaints should be studied so that company's management could have the opportunity to improve consumer perception of service quality. Complaints are useful sources of information that help marketers identify sources of dissatisfaction (Nyer, 2000). However, there is a lack of entailing the customer complaining behavior variable in the CRM systems applied and especially in the agro-food companies.

Gathering feedback from customers through organized marketing policies should be a daily activity of a company in order to maintain satisfied and loyal customers (Holloway and Beatty, 2003). The importance of having an effective system to deal with possible problems and to handle them properly is that it increases retention rates and creates a positive word-of-mouth (Zhang, Ye, Law and Li, 2010). There is a range of e-channels which provide a fast and easy method to express one's experience (Au, Buhalis and Law, 2009), such as social media (facebook, twitter, linkedIn), petition lists to sign, blogs, or even more to some areas special websites. For example in the hotel industry, guests use hotel reviews sites, such as Booking.com, tripadvisor.com, hotelchatter.com and many others to express their feelings. Prior studies (Houser and Wooders, 2006) showed that customers seriously consider online feedback when making purchasing decisions, and may be even willing to pay more for products/services with good reputation. Moreover, more than 60% of consumers consult a customer feedback before making purchases (Lightspeed Research, 2011). Ye, Law and Gu, (2009) present a quantitative analysis that shows how a 10% improvement in reviewers' rating can increase sales figures by 4.4%.

Thus, review websites for products, or more generally electronic means of complaining should be considered by companies and even more from agro-food companies in order to understand their customers complaining behavior, decrease customer dissatisfaction by increasing customer's perceived product quality. To the best of the author's knowledge electronic complaining behavior regarding agriculture

food products has not been studied extensively yet, although it is a quite important industry especially for Greece.

3 Methodology

The survey instrument was a structured questionnaire. There were questions included which identify whether the customer had a previous bad experience with some agro-food products. Then a group of questions investigated the complaining behavior followed. Additionally, the profile of the consumer is investigated regarding demographic parameters and psychographic characteristics.

720 sample members were gathered by interviews electronically or by face-to-face interviews. The sample was not layered to the Greek population.

Descriptive statistics and significance test hypotheses are used in order to statistically process the data. Results of the statistical analysis are followed.

4 Results and Discussions

The majority of the sample was females (54,9%). Regarding the education level of the consumers the fourth of the sample holds a graduate degree or a post graduate degree, 11,1% were students and the rest of the sample has up to 12 years education. 15,8% was aged up to 24 years old, 22,1% was from 25 to 34 years old, 19,3% from 34 to 44 years old and 42% more than 45 years old. 36% of the sample has an annual income up to 10000 euros, 26% from 10001-15000 euros, 15,8% 15001-20000 euros and the rest of the sample more than 20000 euros.

Several reasons have been identified as a source for consumers' dissatisfaction. 23% recognized that the product's quality was not the appropriate and 22% claimed that the product shortly degraded after buy (see Fig. 1).

The interviewees were also asked about what was the most important reason for dissatisfaction in comparison to the others. The results are shown in Fig. 2.

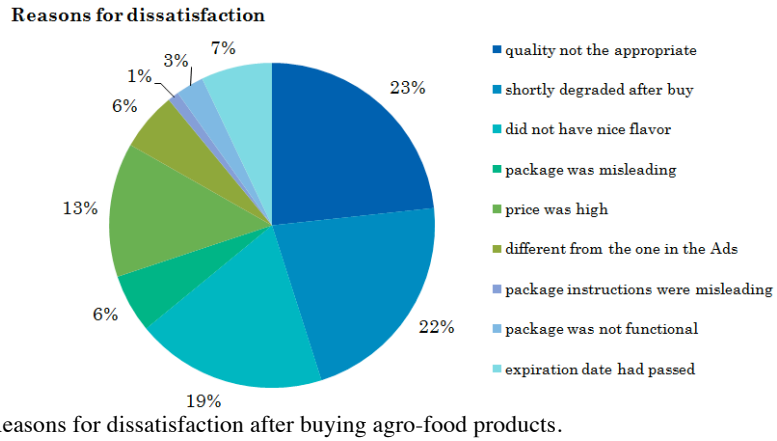

Fig. 1. Reasons for dissatisfaction after buying agro-food products.

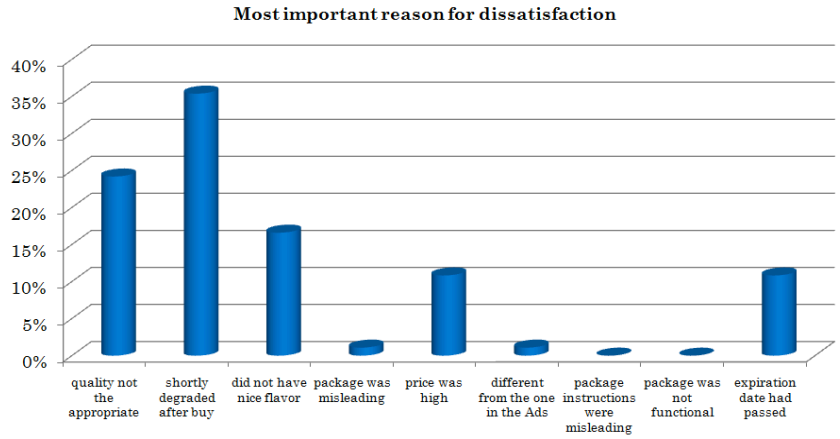

Fig. 2. Reasons for dissatisfaction as ranked the most important.

Regarding the complaining behavior results shown that more than 43% did nothing or just discussed the situation with others, when they experience a problem with an agro-food product (see Fig. 3). The electronic complaining method (i.e. social media publication, blogging or petition signing) is around 2% of the total reactions. The most disappointing result is that 83% intent to have a weak complaining behavior in the future (Fig. 4). The electronic complaining remains rather low as a percentage of the total intended reactions. Both results depicts that e-complaining is in its infant stages in Greece contrary to other divisions of the economy like tourism where it is quite developed. Trying to connect demographics with the complaining behavior of the consumer it is found that gender affects complaining behavior at a significance level less than 0,1 whereas age affects complaining behavior at a level of 0.05.

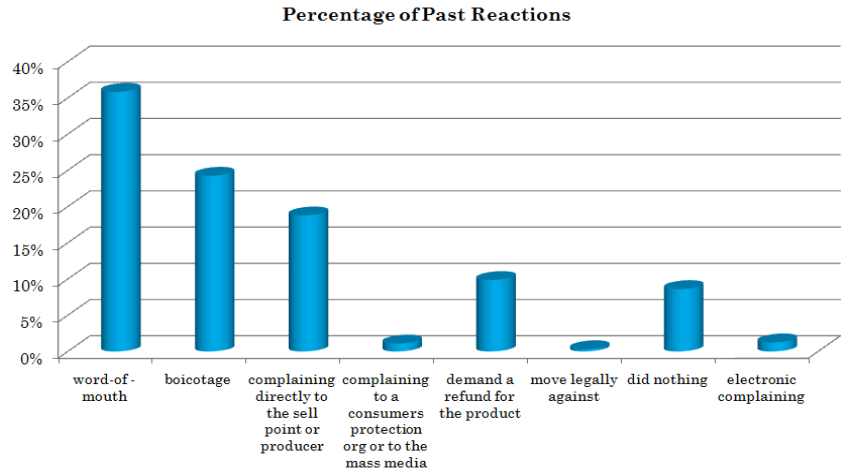

Fig. 3. Complaining behavior of a consumer towards problems originating from agro-food products

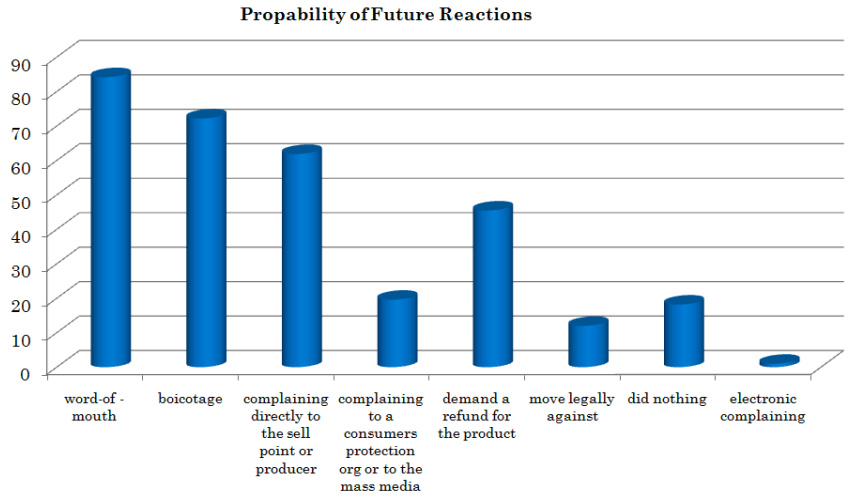

Fig. 4. Complaining intention of a consumer towards problems originating from agro-food products

5 Conclusions

It can be seen that the product quality can be considered as one of the most important reasons that contribute to consumer's dissatisfaction. The latter is very important in building stable relationships with a company's customers and hence, maintaining customers loyal.

Product's quality is the most important reason for not having satisfied agro-food consumers. Regarding their reactions when they face such a bad situation the so called word-of mouth and the boycott are the most popular complaining behaviors. This study reveals that the e-complaining is currently very low. On the other hand word-of mouth and boycott are the most popular complaining intentions. The intention to complain electronically is also rather low around 1%.

Finally, some demographic characteristics like gender and age are related to the degree of the consumer's complaining reaction.

Further research should be made in the area of identifying demographic relationships and e-complaining behavior.

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Session 13: Spatial Modeling

Land as Information. A Multidimensional Valuation Approach for Slow Mobility Planning

Salvatore Giuffrida[1], Filippo Gagliano[2], Maria Rosa Trovato[3]

[1]Department of Civil Engineering and Architecture, University of Catania, Italy, e-mail: sgiuffrida@dica.unict.it
[2]Department of Civil Engineering and Architecture, University of Catania, Italy, e-mail: fmgagliano@gmail.com
[3]Department of Civil Engineering and Architecture, University of Catania, Italy

Abstract. One of the most sustainable ways of improving the landscape value is the valorisation of the countryside dirt road network with the purpose of creating a greenweb, a communication system able to improve the territory attractiveness. The study assumes an axiological approach to land planning, including a qualitative valuation model and an interactive multicriteria tool based on the combination of WebGIS and DRSA tools. The valuation model is based on an axiological pattern taking into account four groups of valorisations according to a semiotic marketing approach. A hierarchic three explains each of them, so that every land object or rail performance can be assessed into a general frame oriented to provide the aggregate value of the path that which they relate, as composed by the GIS network pattern aiming to meet the users' preference profile. The DRSA tool allows generating the preferences structure of the target segments users.

Keywords: Greenways, WebGIS, DRSA, Axiological approach, Qualitative land assessment, Land planning.

1 Introduction

The general trend of the economy dematerialization and the increasing role played by the "experience goods" compared by the "search goods" (Huang et al., 2009) in the customer demand, the enhance and spread of the environmental sensitivity and of the curiosity for the local identities, have nowadays increased the interest in the greenways.

Several initiatives and organizations all over the world arrange tools and provide database aimed at spreading information about the characteristics of the existing greenways in order to attract users and improve the availability of sustainable experiences for recreation.

Actually, a system of GreenWeb can be considered one a way of transferring and sharing land information.

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Landscape can be assumed the shape of a territory, and its multiple and dynamic perspectives accord to the idea of its continuous changing. Furthermore, information is the raw material of communication.

A land improvement policy needs the evaluative knowledge, that is signification activity.

Signification, information and communication are the three main point of a government process aimed at create and maintain a new value system for sustainability (Rizzo, 1999).

The landscape, as a concept, is connected to sustainability perspective of the enhancement of the local anthropic identity (Stephenson 2008), thus confirming its natural and cultural unity. Stephenson remarks the need for assuming "value-as-a-whole", recognising the importance of assessment in land policies.

Greenways, as both a physical infrastructure and a cultural approach to landscape, improved due to a planning international movement (Fabos, 1995), specifically based on assessment to support decisions aimed at combining natural and cultural features, as well as rational and creative approaches (Ahern, 1995; Ribeiro and Bardo, 2006).

A greenways network can connect different anthropic land districts, promote cultural and economic upgrade of rural land, develope sustainability awareness, renovate the scale of values and preferences (Toccolini et al., 2006).

The land social value, because of the impossibility of comparing costs with externalities (Dasgupta, 2000) claims the need of *creating networks* and an interactive assessment model, involving planners and users.

Greenways can be assumed as the physical communicative network of land, through which the users push and spread land information.

This study proposes an assessment and communication WebGIS-DSRA pattern able to create the information the user needs to increase it into the *GreenWeb*.

2 Materials

2.1 Greenways: General Issues and the Case Study

Many different experiences of greenways networks recently developed, and a vast literature exists on the subject, concerning: "multiple-scales; networks for land preservation at the community scale; historical and theoretical greenway issues (Fabos and Ryan, 2006).

Greenways have been made In Italy for about 1500 km, mostly in the northern regions. Most of them follow the path of abandoned railways and allow biking (Dal Sasso and Ottolino, 2011).

The increasing attention around the greenways shows that they are actualized as effective land marketing systems which are helpful to the local economy.

A network of greenways can be considered the land facility by means of which it is possible to realize the most unitary landscape experience, so that it should be assumed in its informational, no more physical, dimension and function.

A green-web is the matrix of multiple and mobile points of view of the landscape, that capitalizes the individual and changeable experiences as a general and social substance of value.

This substance is the core of the reasons and motivations of the land (re)production and use.

Individual perspectives and social values can be connected by an information and decision system in which data are collected and by means of which it is possible to reveal users' preferences.

For this case study, some our elaboration (Fig. 1-2) from the database of the Sicilian Hydrographical Office (1950-2000) and Sicilian Department for Agriculture and Forests (2004) allow to represent the most important terms of this preference pattern.

The Province of Syracuse belongs to the 17th Ambit of Guidelines of the Regional Territorial Landscape Plan, including the geological support named *Tavolato Ibleo*.

The area has a tabular structure composed by terraces overlooking the sea; the altitude range goes from 200 up to 600 m above sea level area.

Two different areas can be distinguished: the high Iblean landscape and the waterfront the description of which can be found in qualified literature (DCEH, Sicilian Region, 1996).

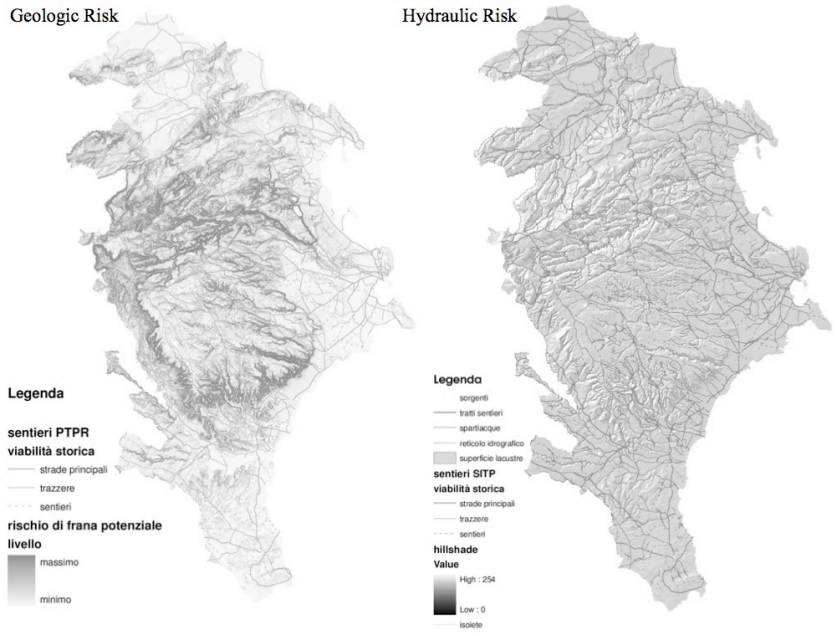


Fig. 1. Practical features: land "discontinuity" (our elaboration from: Sicilian Region, 1950-2000; Sicilian Region, 2004).

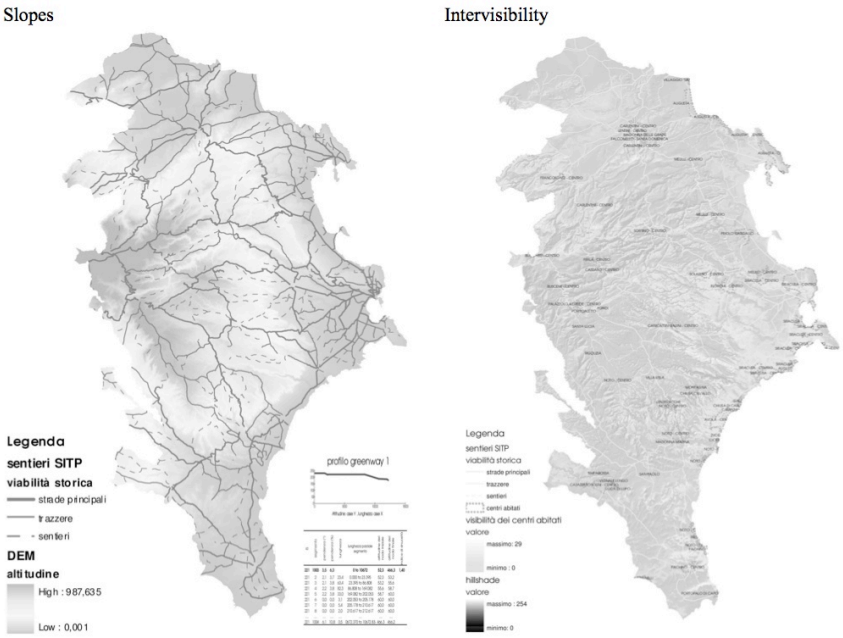


Fig. 2. Critical and playful features. Path "non discontinuity" and "non continuity" (ib.).

3 Methods

3.1 An axiological approach

An axiological approach is a value-centred and value-oriented vision that assumes land as a bundle of combined potential and current social values: the first one is based on objects and performances, the second one depends on the appreciation of them by the users according to the axiological profile their choices are due to.

In order to measure and to map this social value, a specific tool allows the users expressing their preferences and communicate the satisfaction degree of the experiences, so that the evaluator can adjust the tool: the users input their preferences into a form on the Web-GIS interface.

The system proposes a group of paths, which the users can further reduce in order to select the best one, by inserting more specific information about their wishes and expectations.

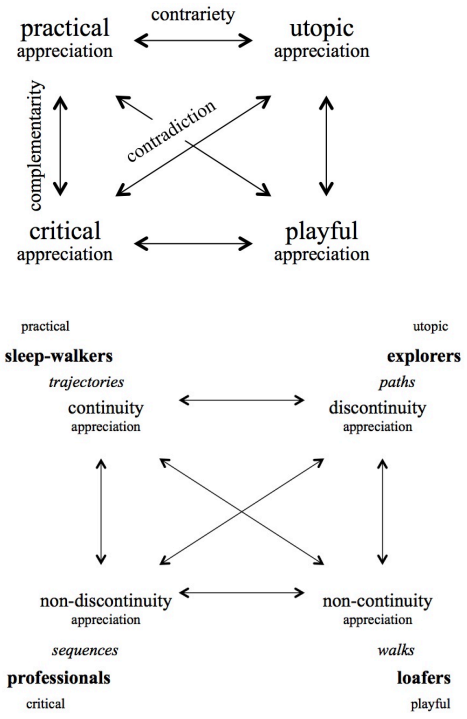
The input form and the related preference pattern are inserted into three different sections each of them each of them referred to one of three different approaches.

Object approach: "value is considered an intrinsic characteristic of an object" or goods, so that the object is required (or rejected) itself. The form to be filled for

selecting the path provides a list including the local landscape attractions. The user selects the ones he wants to come across; the system makes a query and composes all the paths containing the kinds of object indicated in the form.

Performance approach: "an object is relevant by the effect of its performances", which are functional or utility characteristics, so that the same group of performances can be provided by diverse objects. The performances section includes: 1. *measurable performances* (maximum length, slope, car road crosses, …); 2. *valuable performances* (smoothness, hardness, riskiness, …), calculated by using the space analysis Web-GIS functions; the pattern reduces the previous selection so that the user can refine the query up to select the best path.

Axiological approach: "objects and their performances are relevant only in order to achieve a purpose, if traced to a value". The value is attributed to the capability of the path to satisfy some general instances when crossed; objects and performances have no value in themselves; the user assigns to them a value once connected by the path whose configuration is defined by assembling a certain number of path units, so that the value function is optimized.



Appreciations	I level Criteria	II level Criteria
practical	safety	towns proximity
		roads proximity
		path continuity
		geological risk
	comfort	orography
		roadbed
		continuity
		weather conditions
	accessibility	street and towns proximity
		trip roundness
	facilities	facilities proximity
		towns proximity
	transportation options	coaches
		train
critical	duration	time
	length	distance
	efficiency	efficiency
		cultural
	range	naturalistic
		cultural
		recreation
	intervisibility	visible surface
utopic	wildness	traffic distance
		bound areas
	adventure	town distance
		ways of use
		orography
		vegetation
playful	perceptual landscape	quantitative features
		qualitative features
		attractors/detractors
	recreation	facilities

Fig. 3. The axiological square (Floch, 1995) and its adaptation to the study case (left). Appreciations and criteria (I and II level) of the valuation pattern (right; indicators omitted).

The value of a path is the weighed average score calculated going up the WBS from indicators, through subcriteria up to the root-criteria (values) coming from the axiological square by Floch (1995).

It's a general scheme in which four kinds of appreciations are connected by relationships of complementarity, contrariety and contradiction.

They are *practical* (functionality), *critical* (convenience), *utopic* (existential), *playful* (diversity, surprise) appreciations, describing the traveller's profiles.

These values are specified in progressively detailed levels, forming a WBS valuation pattern (Fig. 3), comprising 145 indicators (omitted).

For each of the indicators addressing the last level of the criteria, one or more indices have been identified in order to turn different performances into the same value scale (0 to 2 scores). Some value functions are shown as follows (Fig. 4).

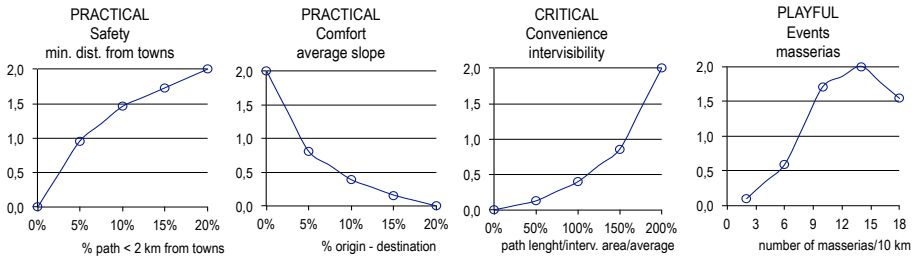


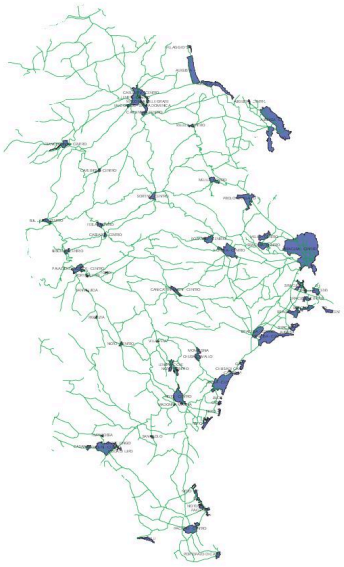
Fig. 4. Sample of transformation of observations into valuations: Practical valorisation (other valorisations omitted).

3.3 Spatial Analysis GIS Tools for Path Arrangement

A *GreenWeb* should be considered, from a topologic point of view, as a set of arcs and nodes linked into a reticular framework connecting the social-land fabric. Each node is usually associated to a value function (Correnti, 2003), but in this experience the value is traced to the path as a whole.

Network Analyst extension is the tool which aggregates the path maximizing this value function. The databank includes the ancient road network (fig. 8) as shown in IGM 1:50.000 maps started in 1965; some groups have been distinguished: main (consular) roads, herds' roads, lanes; 2. ancient railways and baronial shippers along the waterfront (abolished in 1812); all of them have been geo-referenced and featured according to the database coming from the Guidelines of the Territorial Landscape Regional Plan (Department of Cultural and Environmental Heritage and Public Education – Sicilian Region, 1996) and from the Landscape Territorial Plan of the Province of Syracuse (Superintendence of Cultural Heritage of the Province of Syracuse, 2012). By means of the Spatial Join extension and the geoprocessing functions (Biallo, 2005), a new viability database has been implemented by dividing each road into 250 m long segment, so that a continuous greenway can be assembled by joining the arcs which maximize the value function. *Spatial join* and *Range query* are the two geometric operations more frequently used in the geographic data management. The *spatial join* is a relational join in which geometric attribute and space relations are used and imposed instead of alphanumeric ones. There are: *topologic join* that is more speed if the storage structure is based on a set of layers;

there are also *join* based on *direction* and *distance*. The general diagram of the information management is shown in fig. 5 (right).



id	Shape	Categoria	Lunghezza m
1	polyline	Sentieri	3850
2	polyline	strade principali	500
3	polyline	Trazzere	1456
4	polyline	Trazzere	457
.....	.....	.....	.....
377	polyline	Sentieri	678

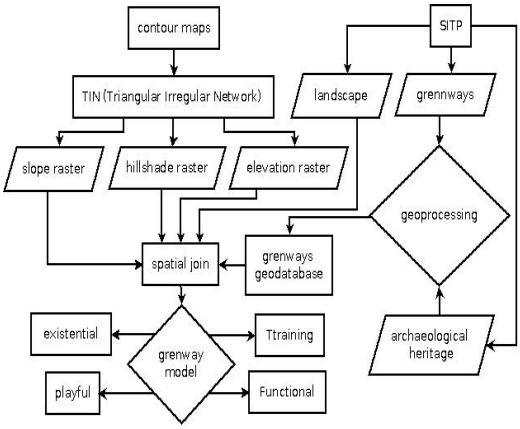
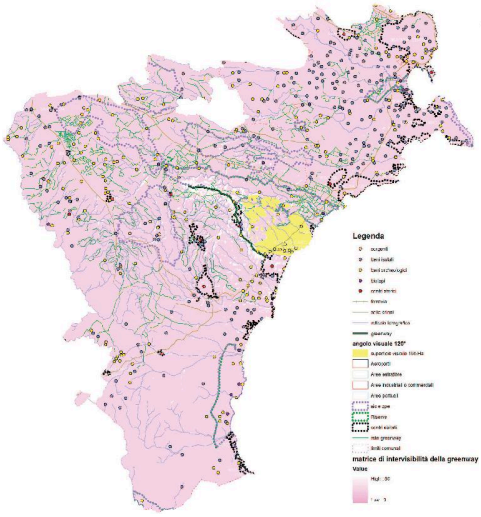


Fig. 5. GIS database sample and dirt road-net.



shape	lunghezza	id sub archi	distanza dal bene archeologico	codice del bene	ambito	numero	comune del bene archeogico	località del bene archeologico	...
polyline	250	1	1003,108	SR206d	17	245	Avola	Tracciato FF.SS.	...
polyline	250	2	860,701	SR206d	17	245	Avola	Tracciato FF.SS.	...
polyline	250,000	3	804,374	SR206d	17	245	Avola	Tracciato FF.SS.	...
polyline	250,000	4	846,315	SR206d	17	245	Avola	Tracciato FF.SS.	...
polyline	250,000	5	981,234	SR206d	17	245	Avola	Tracciato FF.SS.	...
polyline	250,000	6	1054,544	SR196	17	232	Avola	Monte d'Oro	...
polyline	250,000	7	1083,267	SR196	17	232	Avola	Monte d'Oro	...
polyline	39,953	8	1097,625	SR196	17	232	Avola	Monte d'Oro	...
polyline	250,000	9	1310,806	SR206d	17	245	Avola	Tracciato FF.SS.	...
polyline	223,877	10	1160,066	SR206d	17	245	Avola	Tracciato FF.SS.	...
polyline	250,000	11	1272,709	SR300	17	341	Noto	Cava S. Anna	...
polyline	28,153	12	1362,649	SR300	17	341	Noto	Cava S. Anna	...
polyline	56,635	13	1256,909	SR300	17	341	Noto	Cava S. Anna	...
polyline	189,045	14	1172,716	SR300	17	341	Noto	Cava S. Anna	...
polyline	110,976	15	1220,494	SR300	17	341	Noto	Cava S. Anna	...
polyline	250,000	16	913,500	SR206d	17	245	Avola	Tracciato FF.SS.	...
polyline	250,000	17	666,140	SR206d	17	245	Avola	Tracciato FF.SS.	...
polyline	250,000	18	487,484	SR206d	17	245	Avola	Tracciato FF.SS.	...
polyline	250,000	19	469,352	SR206d	17	245	Avola	Tracciato FF.SS.	...
polyline	250,000	20	393,072	SR206d	17	245	Avola	Tracciato FF.SS.	...
...	...	...	...	...	...	...	...	...	...
polyline	250,000	3598	503,072	SR206d	17	245	Avola	Tracciato FF.SS.	...

Fig. 6. Information system and spatial query in a specified area.

4 An Interactive Value Adjustment Pattern Based on DRSA

The greenway can be considered a product-service for the users to improve which an appropriate marketing strategy needs to be identified by coordinating the recreational demand with the local supply, in relation to the target segments of the users.

According to the Floch's four appreciations, that properly describe the users' (tourists') demand typically in a Web 2.0 era, an interactive strategic pattern aimed at identifying and managing the users' behaviour has been drew up, envisaging a recreational context characterized as the transition to Tourism 2.0.

Nowadays Tourism 2.0 can be defined as a way of tourism promotion, which is closely related to the development of Web 2.0.

The development of such a new ICTs helps to coordinate the supply to demand, which is ever changing and more globalized.

Even today, the researchers are working in order to allow an evolution of the use of the web, to support the transition from Web 2.0 to Web 3.0. In this regard, one could speak of a tourism 3.0.

The Web 3.0 fosters the interaction between some different possible paths, allowing a new level of the integration and the interoperability to some applications.

In the case of Web 3.0, there are some fundamental elements creating a Web database which would facilitate the access to the contents of some applications which are not individuated by the browsers, making the most of the technologies which are based on the artificial intelligence (*AI*): the semantic web, the Geospatial Web, etc..

The web GIS is a ICTs tool that, if properly structured, is able to support the development of a Web 2.0 type, and therefore the tourism 2.0.

This tool shows some potentials, which, if exploited, would allow to support a new era of web 3.0 type.

The tools to support the development of a web GIS which is able to meet these requirements are: a data mining and an artificial intelligence tool that produces an output of the informational type for the product or service requested by the user.

To support the extraction and the processing data, we propose the *DRSA* (*Dominance-based Rough Set Approach*) (Greco, Masahiro and Slowinski, 2006).

The DRSA tool is used to generate the preferences structure of the target segments users.

It is used as a basis for the extraction and the processing of the data. It allows to identify the preferences structure to support the GIS tool and the Web GIS tool, to generate the best green way at meeting the user's preferences.

DRSA belongs to the algorithms family called rough sets that are developed by the Operations Research.

In particular, in DRSA the relationship of discernibility (Greco, Matarazzo and Slowinski , 2004a) that is typical for the rough set (*CRSA – Classic Rough Set Approach*) is replaced by a relationship of dominance that makes this tool more flexible and suitable for the analysis of some multi criteria decision problems.

The DRSA enables to generate a minimal set of decision rules in a neutral way. By means of this minimal set it is possible to generate a preferences structure or perceptual-value (Sturiale and Trovato, 2010) structure for the user.

This algorithm also has the advantage of detecting the inconsistencies and the ambiguities of the input data, and helps to converge towards the minimum information structure on which the choice of the user depends.

In this regard, it is considered advantageous to process the information of a data base which is achieved on the basis of some questionnaires to support the feedback for the institutional web that uses the proposed web GIS tool.

The revised information will form the basis for the structuring of the segments of the green way for the different target segments that are considered in the Floch's approach.

5 Results and Discussions

5.1 Valuation model results

The value of a single greenway is given by the four appreciations vectors of scores calculated by aggregating the scores of the relevant characteristics of the land area crossed by the greenway.

In particular, each appreciation corresponding to the more aggregate criterion level is weighed by the user inserting his or her request about the characteristics of the path, thus declaring his or her axiological profile, whereas the weights of the sub criteria are assigned as an hypothesis by the appraiser.

The combined application of the object, performance and axiological approaches is synthesized in fig. 10.

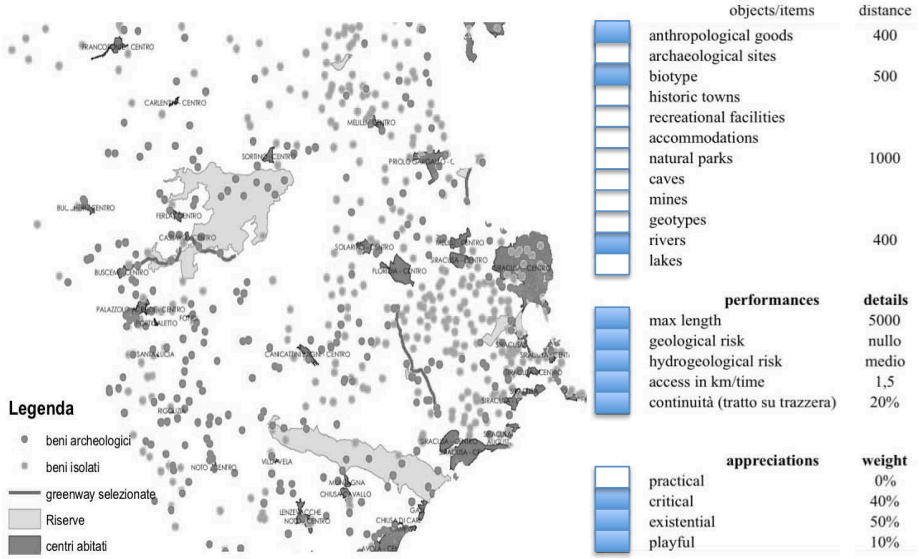


Fig. 7. Insertion of the requested object, performances and the axiological profile.

5.2 DRSA Tool Results

Some questionnaires were structured in order to identify the mode of the choice for the users and administered to a sample of users that have connected to the website that hosts the experimental project.

The questionnaires are proposed at the feedback button on the WebGIS site.

The obtained data were organized in a data base and the obtained information was processed using the DRSA tool (Greco, Matarazzo and Slowinski, 2004) in order to locate a minimal set of decision rules (tab. 1).

Table 1. Appreciations and criteria (I and II level) of the valuation pattern.

	Decision rules
1	If the perception of the landscape has a high importance, then chooses the playful profile
2	If the importance of the efficiency of the route is medium and the level of importance for the recreational facilities is high then choose the playful profile
3	If the importance of the distances is medium, the level of importance for the perceptual landscape is medium and the level of importance for the recreational facilities is high choose the playful profile
4	If the importance of the recreational facilities is high then choose the existential profile
5	If the importance of the recreational facilities is medium then choose the critical profile
6	If the importance of the density of the events is medium then choose the critical profile
7	If the importance of the adventure is medium then choose the critical profile

Subsequently, on the basis of the obtained information, it has been possible to define the preferences structure for the sample.

In particular, in this case, the preferences structure characterizes the user's profile on the basis of the four profile types. The sample was requested to declare its belonging profile.

Then the sample was requested to characterize the different profiles according to Floch's approach on the basis of the identified criteria.

The sample was also requested to declare its preferences about the level of importance of the criteria, i.e. the weight or the value that these criteria have at choosing the green way.

The quality percentage of the approximation of classification is in this case the 68%. The quality of approximation of the classification represents the relative frequency of the objects correctly classified by means of the attribute.

In particular the quality of the classification satisfies the properties of set functions called fuzzy measures.

A fuzzy measure constitutes a useful tool for modeling the importance of the coalitions.

But a fuzzy measure can be used to assess a relative value of information supplied by each attribute, and to analyze the interactions among attributes (Greco, Matarazzo and Slowinski, 2001), basing on the quality of classification calculated from the rough set approach.

Table 2. The preferences structure to support the critical, utopic and playful profile.

Critical profile
If the importance of the recreational facilities is medium then chooses the critical profile
If the importance of the density of the events is medium then chooses the critical profile
If the level of importance for the adventure is medium then chooses the critical profile
Utopic profile
If the importance of the recreational facilities is high then chooses the existential profile
Playful profile
If the perception of the landscape has a high importance, then chooses the playful profile
If the importance of the efficiency of the route is medium and the importance of the recreational facilities is high then chooses the playful profile
If the importance of the distances is medium, the importance of the perceptual landscape is medium and of the recreational facilities is high then chooses the playful profile

Then the quality of the approximation of the classification can help to identify the weights as relative value of information supplied by each attribute (Trovato, 2013).

In the end it was possible to characterize three profiles: the critical, the existential and the playful ones.

The results showed the absence of a characterization of the practical profile for the user (Tab. 2).

The DRSA tool has allowed identifying the core approximation, i.e. the criteria that are more important for the choice of the different profiles, in this case, the perceptual landscape and the level of recreational facilities.

They are present in all profiles, so that they most influence the choice of the path. The obtained data are still partial but this test can be considered satisfactory at this first stage. The general scheme of the DSRA-WebGIS participation pattern is shown in fig. 8.

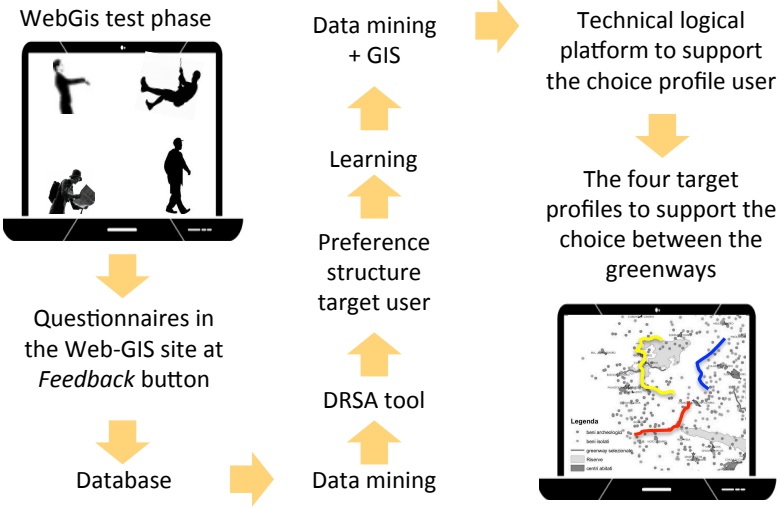


Fig. 8. The general DRSA-WebGIS participation scheme.

6 Conclusions

A green-web is an immaterial infrastructure, a phase of the information cycle – information, whose origin is the organization of the land knowledge and the access to it through of a personalized consultation system.

These three parts, between which the "value/valuation" is the most relevant one, are involved in the feedback process at the three levels of *data/information*, *value/valuation*, *planning/communication*.

1. At the first level the experience we have carried out has been an important test about the connection between data and value, so that the knowledge system has been completely redrawn; values need some specific data, and in particular an appropriate way of turning them into information;

2. At the second level, the valuation one, the value system has been assumed as the matrix of the knowledge whose wide articulation has to be reduced to some axiological relationships, in order to create a shareable communication system: an axiological approach connects the data and plan levels.

3. At the third level, the experimentation of the DRSA method has shown how it is possible to connect a valuation model to a planning approach; the interaction between user and decision-maker through the valuation model provides useful insights about what part of the land has to be enhanced and what supply chains need to be boosted for the general equalization purpose.

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Fine Scale Climate Change Analysis: from Global Models to Local Impact Studies in Serbia

Ana Vukovic[1,2], Mirjam Vujadinovic[3,2], Vladimir Djurdjevic[4,2], Bojan Cvetkovic[2], Zorica Rankovic-Vasic[3], Zoran Przic[3], Mirjana Ruml[3], Aleksandra Krzic[2]

[1]Faculty of Agriculture, University of Belgrade, Serbia, e-mail: anavuk@agrif.bg.ac.rs
[2]South East European Climate Change Center, RHMSS, Belgrade, Serbia
[3]Faculty of Agriculture, University of Belgrade, Serbia
[4]Faculty of Physics, University of Belgrade, Serbia

Abstract. Climate change studies involve changes in climate system of global long-term scales with effects on regional and local climates, down to short-range time scales, like weather hazards and extremes. Climate studies significantly contribute to the future strategic planning in economic development and thereby must produce results with high level of confidence. Global climate models simulations of the past and future climate are initial step in climate change research, but their coarse resolution data are unable to provide useful information for analysis on national levels. In this paper is presented workflow algorithm of the procedures necessary to convert coarse global climate system projected changes to fine scale data with included effect of small scale features and reduced model bias impact.

Keywords: climate change, climate model, bias correction

1 Introduction

Global climate models (GCMs) are designed to resolve large scale physical processes of the atmosphere-ocean-land system on coarse-grid resolution, and obtained data are insufficient for regional or local impact assessments. Downscaling of the GCM data can be statistical or dynamical. Statistical downscaling considers creation of statistical relations between simulated and observed data, and their application on the future climate projections. Dynamical downscaling of GCM data is much more complex and involves climate simulations with the nested regional climate model (RCM) with finer resolution. The second approach is much more expensive in computing time but enables smaller scale features of the climate system to react on global scales climate changes, which makes this method more reliable for the use in climate change studies. Model bias, i.e. systematic model error, is reduced applying downscaling on higher resolutions, but still remains with considerate effect on results quality. Usual approach in presenting model data, to avoid impact of model bias, is "delta" approach (difference of climate values obtained from the model future climate and past climate simulations). For impact studies this approach is

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insufficient, and it usually requires use of daily model data as input for other models (crop models, hydrology models, etc.) or for calculation of different indices, which are not linearly dependent on model output data. In this case bias correction of daily model data must be applied. Model bias is a consequence of different parameterizations used in model and imperfect input data. It changes in time and space and is different for each model.

Coarse RCM simulations using SRES/IPCC scenarios A1B and A2 (Nakicenovic eta al., 2000, IPCC, 2007) with statistical bias correction using EOBS gridded data are applied so far in impact studies in Serbia, and documented in Initial and Second National Communication of Republic of Serbia (Djurdjevic et al., 2011, Rajkovic et al., 2014, and references within).

In this paper is presented downscaling of the global model CMCC simulation for the period 1971-2100 to fine scale using nested model NMMB for the South East Europe region, performed under the ORIENGATE project (Djurdjevic and Krzic, 2013a). Future climate simulation is done according to extreme RCP8.5 scenario (IPCC, 2013). Period of simulation 1971-2000 is used for model bias correction of daily temperature data. Interpolation of daily temperature data is done for the territory of Serbia using all available observations from national network, and near boundary available data from border countries. Observations are interpolated on model grid. The same dataset of observations and interpolation method is used for climate analysis in project related to the renewal of viticulture zoning (Ivanisevic et al., 2015). Using model and observed data, for each month and for each grid point are created correction functions, which are applied on the past and future climate simulation results. After applying bias correction we can assume that model bias is reduced to minimum. Use of corrected model data is shown with short analysis of annual and seasonal temperature change and change of several climate indices related to temperature extremes.

2 Model Simulation

Regional climate model simulation is done for the period 1971-2100, using RCP8.5 scenario (IPCC, 2013). Global climate model CMCC-CM (Scoccimarro et al., 2011) simulations are used as boundary conditions. GCM resolution is 0.75°. Dynamical downscaling with NMMB model (Djurdjevic et al., 2013b) is done to the 0.06° resolution, for the SEE region presented in Fig. 1. High-resolution model simulation can resolve fine scale features and increase quality of the summer convective precipitation, which is related to the non-hydrostatic mode of simulation.

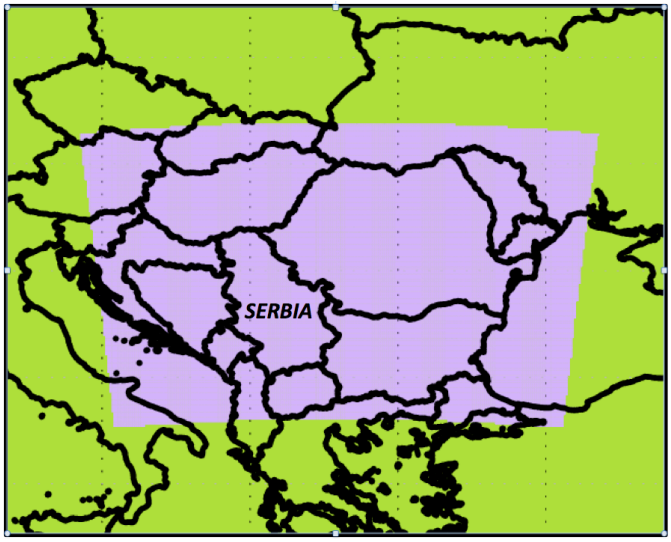

Fig. 1. NMMB domain of simulation for the period 1971-2100 using RCP8.5 scenario (purple)

Comparison of the GCM and RCMs resolutions is presented in Fig. 2, together with original 0.004° DEM topography dataset. RCM 0.25° resolution is used for regional coupled atmospheric-ocean EBU-POM model simulations using SRES A1B and A2 IPCC scenarios, which is so far used for regional and national climate studies and documents Initial and Second National Communication for Serbia (Djurdjevic et al., 2011, Rajkovic et al., 2014). Fig. 2 evidently shows deficit of GCM resolution and large improvement in increasing RCM resolution, having in mind complexity of Serbian terrain. High resolution approach enables climate change analysis on local scales. More on NMMB performance in climate simulations can be found in Djurdjevic and Krzic (2013a).

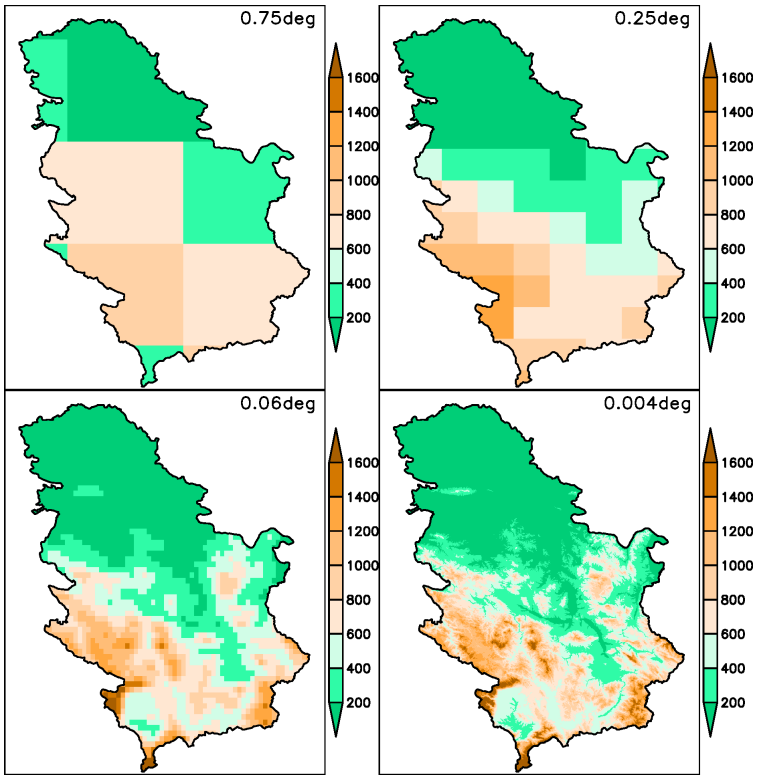

Fig. 2. Topography on GCM (upper left), coarse RCM (upper right), fine RCM (lower left) and DEM (lower right) resolutions.

3 Bias Correction

Bias correction of the model data in time and space it is necessary to produce daily data interpolated on model grid for the reference period 1971-2000. For interpolation are used all available observations for daily maximum, minimum and mean temperature from 103 sites from national network and 32 sites near border from surrounding countries. Interpolation of daily data is done for the territory of Serbia using method of successive corrections (Cressman, 1959). This method is in use usually for numerical weather forecast purposes and represents optimal combination of simplicity, computational efficiency and quality of the obtained interpolated data. It is used for the climate analysis in project national viticulture zoning (Ivanisevic et al., 2015).

Statistical bias correction is done creating correction functions for each model grid point, for each month and for each temperature separately, under the assumption that cumulative density functions of the model and observed data have the same values.

Model and observed temperatures is assumed to follow Gaussian distribution. In Fig. 3 is presented example for one month mean temperature probability and cumulative density functions of model and observed data, and obtained correction function, which has function to assign to model data appropriate observed value. More about statistical bias correction can be found in Ruml et al. (2012).

After creating correction functions they are applied on model data for three 30-years periods, base period 1971-200 and two future climate periods 2011-2040 and 2071-2100.

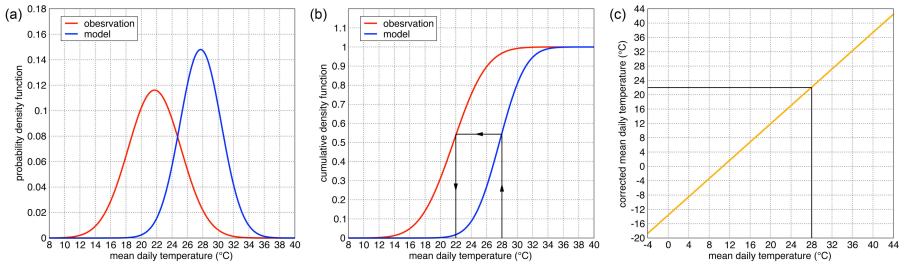

Fig. 3. Probability density functions (a), cumulative density functions (b) for the observed and model mean daily temperature data, and the correction function (c).

4 Results and Discussions

Corrected model results have model bias reduced to the minimum. Such data are can be used in different impact studies, under the assumption that model bias will not have impact on the quality of the derived conclusions (Ruml et al., 2012).

In Fig. 4 and Fig. 5 are presented mean annual and seasonal temperature changes, for the periods 2011-2040 and 2071-2100 with respect to the period 1971-2000 according to the RCP8.5 scenario, respectively. Temperature change during the period 2011-2040 shows increase in all seasons. Mean annual temperature change is in the range 1.6-2.0°C, but with larger values over lower altitudes and during the winter period with increase over 2.6°C in the large part of the country. During the period 2071-2100, in other words during after one century period, expected mean annual temperature change is over 5.6°C over the large part of the country with maximum changes going over 6.4°C. Again, largest projected change is for the winter season. In both periods fall season has larger increase in temperature than spring and summer.

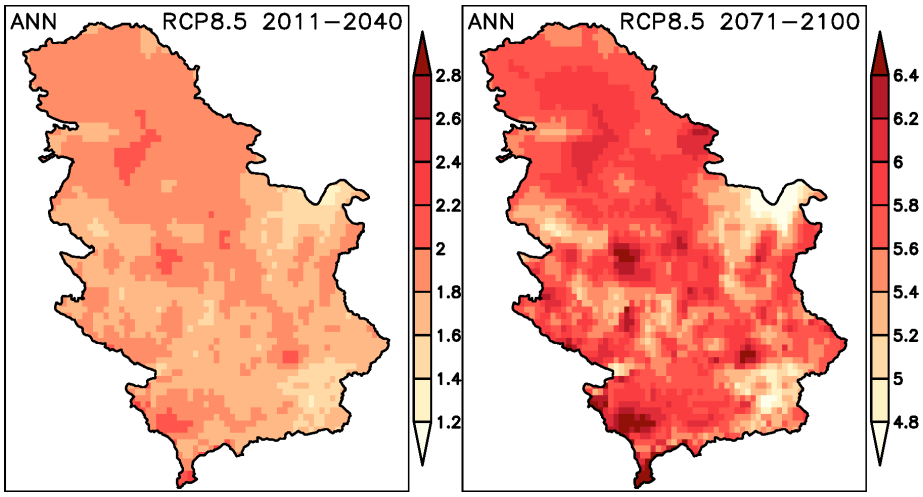

Fig. 4. Mean annual temperature change for the periods 2011-2040 and 2071-2100 with respect to the period 1971-2000, according to the RCP8.5 scenario.

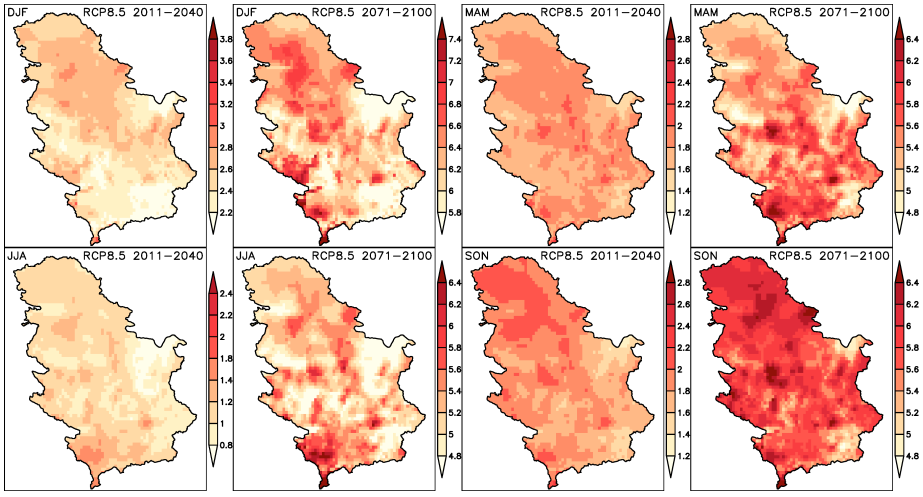

Fig. 5. Mean seasonal temperatures change for the periods 2011-2040 and 2071-2100 with respect to the period 1971-2000, according to the RCP8.5 scenario.

Several extreme temperature indices related to temperature extremes are selected for analysis in this paper. Number of ice days (ID, maximum temperature T_x<0°C) and frost days (FD, minimum temperature T_n<0°C) changes are shown in Fig. 6. During the period 2011-2040 decrease in ID and FD with respect to 1971-2000 is significant. Decrease of FD is larger in lower altitudes, which is related to temperature decrease pattern. ID decrease is higher in higher altitudes because it

already reached point of very rare event in lower altitudes. During the period 2071-2100 decrease in ID and in FD is significantly larger in higher altitudes. This is related to the fact that by the end of the century can be accepted that in lower altitudes temperatures bellow 0°C almost never appear.

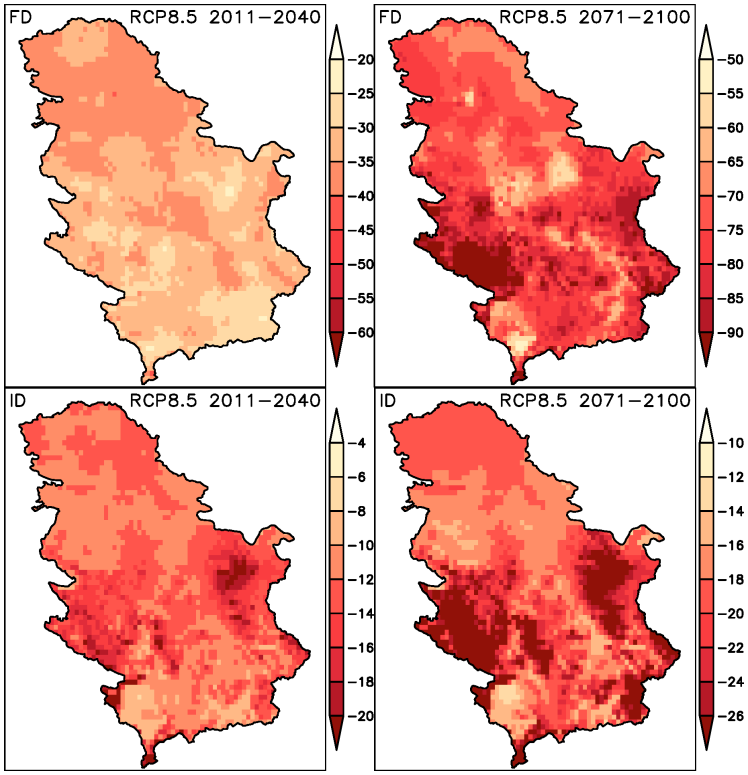

Fig. 6. Number of frost (FD) and ice days (ID) change for the periods 2011-2040 and 2071-2100 with respect to the period 1971-2000, according to the RCP8.5 scenario.

Number of summer days (SU, T_x>25°C) and tropical nights (TR, T_n>20°C) are shown in Fig. 7. During the period 2011-2040 increase in SU over 16 days in most part of the country shows significant expansion of the summer season. TR is appearing over lower altitudes and increase is up to 10 days. By the end of the century SU increase goes over 60 days, which suggests expansion of summer season by two months. TR increase is over 30 over the large part of the country, which means that climate over the territory of Serbia by the end of the century will reach subtropical/tropical climate characteristics.

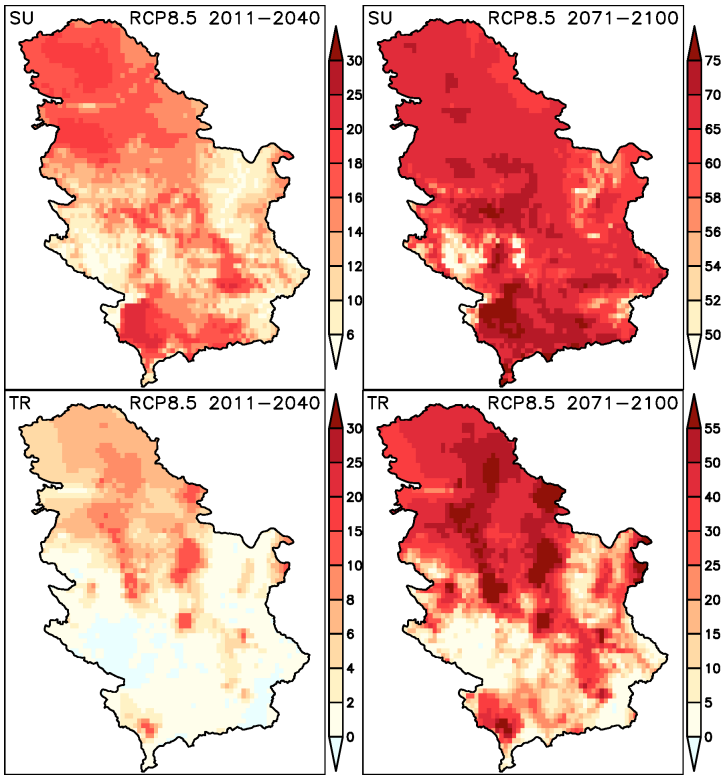

Fig. 7. Number of summer (SU) and tropical nights (TR) change for the periods 2011-2040 and 2071-2100 with respect to the period 1971-2000, according to the RCP8.5 scenario.

Other analysis (not shown here) shows extension of the growing season length 20-30 days during the period 2011-2040 and over two months by the end of the century. Increase in tropical days (T_x>35°C) also confirms climate change pattern toward much lower latitudes climate. Precipitation change in general shows some increase in annual cumulative values with highest increase during the spring season during the period 2011-2040. During the other seasons in some areas is expected small reduction. During the period 2071-2100 annual precipitation is decreasing over 10%, with significant reduction during summer season (over 40%), which is the season with highest precipitation values. This suggests high risk of summer draught hazards.

5 Conclusions

In this paper is given short review of the current work on high resolution climate change analysis with the main goal to obtain reliable model data. They can be used in development of national adaptation strategies and planning of the future economic development, which is mostly related to the agriculture and thereby closely

connected to the climate factors. Serbia is a country with small-scale terrain features with economy mostly based on local landowners agricultural production, which is the reason for the high resolution approach. Following work will be focused on improvement of the interpolation method with further quality check of the collected observations. Database of corrected model daily precipitation data will be created. Having high resolution of daily temperature and precipitation data with reduced bias enables model data use by experts from other disciplines (biology, medicine, hydrology, agriculture, forestry, etc.) and production of the reliable information for the decision makers.

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Open Data in Regions from the Users' Perspective: an Analytical Study

Miloš Ulman[1], Edita Šilerová[2], Jan Masner, Michal Stočes[2], Pavel Šimek[2], Petr Benda[2]

[1]Department of Information Technology, Faculty of Economic and Management, Czech University of Life Sciences in Prague, Kamycka 129, 165 21 Prague Suchdol, Czech Republic, e-mail: ulman@pef.czu.cz
[2]Department of Information Technology, Faculty of Economic and Management, Czech University of Life Sciences in Prague, Kamycka 129, 165 21 Prague Suchdol, Czech Republic

Abstract. The paper is focused on open data in regions from the users' perspective and presents the perceived usability of various public data sets in the Czech Republic. There were 265 data sources assessed by respondents according the format, suggestions of further use, number of views, and usability for citizens, businesses, officers and other users. Only 14 datasets from national public agencies were already provided as open data, but none at the local level. The most frequent formats of data were DOC, HTML, PDF and XLS. The respondents came with 36 different suggestions for the further use of data sets. Currently, the citizens cannot see the difference in usability of open and non-open data unless there are particular applications available. Nationwide data sets were assessed in usability on average better (1.57) than local data sets (1.93). The usability of data was evaluated similarly across observed regions beside those provided by national institutions.

Keywords: Open data, open government data, user's perspective, region, local government, usability.

1 Introduction

Open data is the term that echoes from local and world media with growing frequency. Open data are complete, easily accessible, machine readable, using open standards (e.g. CSV or XML) and published with an open license (Auer et al, 2007). The term of open data firstly gained popularity in academia where it denotes effort to publish academic data under free access in special digital depositories (Murray-Rust, 2008). Now the idea of open data is mainly perceived with political meaning, especially, due to the launch of government open data portals data.gov and data.gov.uk in the U.S. and the U.K. (Kassen, 2013) and with the start of initiatives such as Open Government Partnership. Making public sector information freely accessible in open formats is also referred as *open government data (OGD)* (Kalampokis et al, 2011; Shadbolt et al, 2012).

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Benefits and advantages of using open data provided by government and public agencies (or open government data) are promising for the public administration and for private sector (World Bank, 2014). But most public organizations have no or limited interaction with data users and are often very selective in communication (Susha et al, 2015). Some authors propose that open data rather should be a way for government to interact with citizens (Sieber & Johnson, 2015).

The Czech Republic has committed to implement open government data by joining the Open Government Partnership in 2011. Since then a number of OGD activities have been started at different levels of the public sector as well as in academia and other domains. Although there are some challenges that the Czech Republic needs to face – like the missing official OGD catalogue, some public sector bodies have already started to publish open government data (Chlapek et al, 2014). There are several pioneering organizations that started as first and have showed already some tangible results. Among these organizations belong national state agencies (namely the Ministry of Finance, Czech Trade Inspection or Czech Telecommunication Office), regional administrations (e.g. Vysocina region) and municipalities (e.g. Prague, Decin, Opava). The national open data catalogue of the Czech Republic has been recently launched within the main government portal portal.gov.cz. There are concentrated all datasets from national public institutions that have opened their data so far. The main resource is the register of public contracts that provides scanned copies of all public tender contracts with metadata in XML for automated processing.

Enormous data volumes are generated on daily basis by municipalities and regional authorities. The demand for public data in open format and the number of relevant applications are expected to be steadily growing as an effect of the increase in the level of digital skills and demand for information for example among inhabitants in rural areas (Vaněk et al, 2011) and small farmers (Kubata et al, 2014). The extend of open data sources could have a positive impact on areas such as tourism (Šilerová, 2013). Some authors argue that the potential of the open data concept can be realized at the local level (Kassen, 2013). Contributions and particular impacts of open data on rural life should be examined and researched. The Department of Information Technologies FEM CULS Prague has started cooperation with Czech Ministry of Agriculture on the research of open data in agriculture and rural regions.

There are two aims of the paper: firstly, to estimate the potential of open data sources at the national and regional level, and secondly, to evaluate user's view of open data usability in the Czech Republic.

2 Materials and Methods

Particular research questions that were examined in the survey were stated such as:

1. The number of potential data sets identified for opening and the number of suggestions for the further use of open data was rather higher at local or regional administrations than at the national level.

2. There are differences in estimated usability related to the type of the municipality and the user group.
3. There is a significant difference in usability of open data and data that are not open.
4. There are differences in estimated usability related to the size of the municipality population.

Based on research questions further statistical processing was conducted. The methodological approach used in the paper is both of qualitative and quantitative nature and includes literature review, user interviews and descriptive analysis. The data were processed with association tables, descriptive statistics and tests to compare differences in values.

3 Results and Discussion

Data were collected through questionnaire form administered to citizens living in various regions. In total, there were 265 data sets assessed by respondents in terms of format, suggestions of further use, number of views, and usability for citizens, businesses, officers and other users. The perceived usability of data sets was ranked on the scale from 1 (the best) to 5 (the worst). Basic data are summarized in Table 1.

Table 1. Data sets overview from the survey.

Location	Data sets	Open data	Suggestions
Local	216	0	26
National	49	14	10
Total	265	14	36

Source: self-authored, 2015.

The collected data represent 52 municipalities from 9 regions (including the capital Prague), 8 public institutions (7 schools and 1 school dormitory) and 11 state bodies in the Czech Republic. The most frequently evaluated types of data sets were: obligatory information published on public office website (also called as “e-desk”) (33 %), budget information (33 %), annual report (13 %), newsletter (10 %) and decision of representatives (10 %). In the survey focused on the openness to information disclosure among between 395 municipalities (with up to 2,000 inhabitants) in one region of the Czech Republic in 2009 (Bachmann, 2012), it was found that 71 % of municipalities published electronically minutes from the municipal council meetings, and 28 % electronic periodicals (newsletter). In the survey between 400 municipalities across the whole Czech Republic in 2012, there were 27 % of municipalities publishing resolution from the municipal council meetings, 17 % resolutions and minutes, and 40 % of municipalities publishing newsletter. The procurement information was published only in 30 % of cases. However there is a significant correlation between the size of municipality population and its information openness (Bachmann & Zubr, 2014).

There were 16 various formats of data sets identified such as DOC, HTML, XLS, PDF, XML, CSV and other. Additional 6 various combinations of certain formats were used and some datasets were already provided in the form of a web application. Respondents came with particular ideas of further use of data sets in open format in 36 cases (13.6 %), while 14 (5.3 %) data sets were already provided according to open data principles. The remarkable finding is that all open data sets were provided by state administration bodies and none by local authorities. However more suggestions came for local data sets (26) than for national (10). The most suggestions for the further use of data were declared with files in PDF (9 suggestions), HTML (8), XLS (5), HTML combined with PDF (4) and CSV (4). The first research assumption was confirmed since the availability and the number of inputs for data sets use is prevailing at regional level.

The second question was explored by conducting a statistical analysis. Regarding the nature of gathered data differences among mean values were examined by the analysis of variance and several non-parametric tests. We found that data usability evaluation does not have normal distribution and samples are of different size. ANOVA test assumptions such as normality and symmetry of sample distribution were not fully satisfied, so non-parametric tests were also employed, namely Kruskal-Wallis, Leven's test (means) and Welch's test (Lantz, 2013; Zimmerman, 2011). The statistical hypotheses that were tested are presented in Table 2.

Table 2. Statistical hypotheses related to data sets usability evaluation

Hypotheses	
H1	There is no significant difference between the type of format of the data set and its usability (from the citizen's perspective).
H2	There is no significant difference between the local and national providers and the estimated usability (from the citizen's perspective).
H3	There is no significant difference between regions and the estimated usability (from the citizen's perspective).
H4	There is no significant difference between the evaluation of the data set usability and the user group.
H5	There is no significant difference in usability between data provided as open data and non-open data.
H6	There is no significant difference in usability between municipalities according to size of population.

Source: self-authored, 2015.

Basic descriptive statistics and results of hypotheses testing are presented in following tables (Table 3 – 12).

Firstly, we focused on differences between data format and perceived usability of data. Based on results in Table 4, we can conclude that there are no significant differences in the means and the type of format has no influence on the perceived usability of data. It is needed to add that only three data formats were included because the other had less than 10 evaluations that might affect reliability of results. Selected formats (DOC, HTML, PDF, XLS) are also typical for publishing data on web, however technically, PDF is considered to be one-star data according to the five-star data concept (Berners-Lee, 2010).

Table 3. Formats and usability from the citizen's perspective - descriptive statistics.

Groups	Count	Sum	Mean	Variance	SS	Std Err
DOC	17	35	2.0588	0.6838	10.9412	0.2284
HTML	81	150	1.8519	0.9528	76.2222	0.1046
PDF	77	144	1.8701	0.7724	58.7013	0.1084
XLS	29	58	2	1.125	31.5	0.1749

Source: self-authored, 2015.

The interesting finding brings the frequency analysis of formats usability evaluation. Data sources were assessed with 1 or 2 in usability in particular formats: DOC (64.7 %), HTML (75.9 %), PDF (80.5 %) and XLS (75.9 %). So having data in one of these formats is likely to be perceived positively.

Table 4. Formats and usability from the citizen's perspective – differences testing, α=0.05.

	ANOVA	Kruskal-Wallis	Welch's	Levene's
p-value	0.7777	0.6798	0.7671	0.5844
significant	no	no	no	no

Source: self-authored, 2015.

Many examples of successful open data applications are based on data sets provided by nationwide authorities such as police or national health agency, but we suppose that there are myriads of opportunities to exploit data from local or regional resources. The respondents spotted 216 various local data sources (see Table 5). However, none of local data sets was served in an open data format. There were some significant differences in average values (and medians according to the Welch's test) of usability between national and local data sets (see Table 6). Thus, the hypothesis no. 2 (H2) has to be rejected.

Table 5. Usability of local vs. national open data from the citizen's perspective - descriptive statistics.

Groups	Count	Sum	Mean	Variance	SS	Std Err
Local	216	418	1.9352	0.9260	199.0926	0.0653
National	49	77	1.5714	0.9063	43.5000	0.1372

Source: self-authored, 2015.

The evaluation of the usability was positive (1 or 2) at local resources in 75.5 % of cases and at national resources in 89.8 % of cases.

Table 6. Usability of local vs. national open data from the citizen's perspective – differences testing, α=0.05.

	ANOVA	Kruskal-Wallis	Welch's	Levene's
p-value	0.0174	0.0049	0.0185	0.8265
significant	yes	yes	yes	no

Source: self-authored, 2015.

Collected answers were categorized according the municipalities and regions where data were originated or related. In Table 7, there are four regions that provided at least 10 scores: whole Czech state administration (CZ), Olomoucký region (M), Plzeň region (P) and Ústí nad Labem region (U). The differences between regions were not statistically significant with 95 % probability (see Table 8). The other regions that were presented in responses, but not included in computation, were: South Bohemian region, Pardubický region, Vysočina region, Karlovarský region and Moravia-Silesian region.

Table 7. Regions and usability - descriptive statistics.

Groups	Count	Sum	Mean	Variance	SS	Std Err
CZ	49	77	1.5714	0.9063	43.5	0.1331
M	38	76	2	1.13514	42	0.1512
P	139	255	1.83453	0.80576	111.1942	0.0790
U	11	20	1.81818	0.56364	5.6364	0.2810

Source: self-authored, 2015.

The frequency of positive evaluation (1 or 2) of data sources usability across regions was distributed such as: national (89.8 %), Moravian-Silesian region (76.3 %), Plzeň region (78.4 %) and Ústí nad Labem region (81.8 %).

Table 8. Regions and usability – differences testing, α=0.05.

	ANOVA	Kruskal-Wallis	Welch's	Levene's
p-value	0.1836	0.0972	0.2533	0.9122
significant	no	no	no	no

Source: self-authored, 2015.

The usability from the perspective of citizen, business and public administration (PA) staff was examined and summarized in tables 9 and 10. However, the results were not unanimous and we cannot simply tell whether or not there are any differences in usability evaluation. From the descriptive statistics (see Table 9), we can see that the variance and mean values from business users remarkably differ. ANOVA and Levene's tests that examine differences in means signalize that there are no significant differences, however, Kruskal-Wallis and Welch's test indicate the opposite (see Table 10). Actually, the responses were given by citizens rather than by business people or public officers. This fact might have significant impact on data.

To answer the second research question supposing difference in data usability among regions and user groups, we can conclude that the usability was evaluated similarly across observed regions and between user groups. On the other hand, the data sets provided by national institutions were ranked with better score than regional sources (see Table 5).

Table 9. Usability of open data according user groups - descriptive statistics.

Groups	Count	Sum	Mean	Variance	SS	Std Err
Citizen	265	495	1.8679	0.9389	247.8774	0.0640
Business	60	135	2.25	1.8178	107.25	0.1344
PA staff	58	109	1.8793	0.9852	56.1552	0.1367

Source: self-authored, 2015.

The evaluation of usability according user groups ranked 1 or 2 in 78.1 % (citizen), 68.3 % (business) and 79.3 % (PA staff) of cases.

Table 10. Usability of open data according user groups – differences testing, α=0.05.

	ANOVA	Kruskal-Wallis	Welch's	Levene's
p-value	0.0351	0.2814	0.1204	0.0021
significant	yes	no	no	yes

Source: self-authored, 2015.

The third research question was to reveal the users' point of view on usability of data provided in open format and data that are not open yet. The descriptive summary is presented in Table 11. There were only 11 open data sets evaluated by users against 254 non-open data sets. Some significant discrepancy in mean values was confirmed only by Levene's p-value, but other test results including ANOVA prevented from rejecting the hypothesis about equality of mean values (see Table 12).

Table 11. Usability of open data and non-open data from the citizen's perspective - descriptive statistics.

Groups	Count	Sum	Mean	Variance	SS	Std Err
Open data	11	25	2.2727	2.6182	26.1818	0.2916
Non-open data	254	470	1.8504	0.8688	219.8150	0.0607

Source: self-authored, 2015.

There was also no remarkable difference in the frequency of a positive evaluation of data usability between open data (63.6 %) and non-open data (78.7 %).

Table 12. Usability of open data and non-open data from the citizen's perspective – differences testing, α=0.05.

	ANOVA	Kruskal-Wallis	Welch's	Levene's
p-value	0.1574	0.7800	0.4102	9.1636E-05
significant	no	no	no	yes

Source: self-authored, 2015.

We can conclude that citizens can hardly see any difference between open and non-open data in terms of the usability. Unless there are particular applications based

on open data much interest cannot be expected. The value of open data materializes only upon its use (Susha et al, 2015).

Table 13. Usability and size of municipality population – differences testing, α=0.05.

	ANOVA	Kruskal-Wallis	Welch's	Levene's	significant
Citizen	0.0292	0.0876	0.0636	0.9554	no
Business	0.1766	0.5432	0.0139	0.0002	no
PA staff	0.3064	0.4517	0.1777	0.0028	no

Source: self-authored, 2015.

The fourth research question and resulting final hypothesis were to examine differences among municipalities of different size. In the Table 13, we can see comparison of testing differences in usability between municipalities (without schools and national institutions) according to size of population. There were four different categories of the population size: under 2,000 inhabitants, between 2,000 and 4,999, between 5,000 and 9,999, and over 10,000. The categories follow guidelines of the Czech Statistical Office (CZSO, 2011). Because there was no sample where all test criteria would be significant, we could not reject the null hypothesis and we should state that there are no significant differences between mean values of the usability evaluation. The benefit from using data was not affected by the size of municipality population from the perspective of respondents. However, the respondents did not need to be residents in the respective municipalities. The number of population had some significant effect in the evaluation of municipality openness to information disclosure (Bachmann, 2012; Bachmann & Zubr, 2014).

4 Conclusion

Based on the survey, it can be concluded that data sets provided by national state agencies and authorities are more frequently in line with open data principles, while at the regional level there are still large resources that could be unleashed under open data concept. Citizens and businesses come in contact rather with local than national authorities and they could take better advantage of novel applications and services based on open data if they exist.

The main highlights of the survey findings are summarized under:

- In the sample of 265 data sets, the most frequently published data were: obligatory information published on public office website (also called as "e-desk") (33 %), budget information (33 %), annual report (13 %), newsletter (10 %) and decision of representatives (10 %);
- Out of 265 data sets, there were 216 data sets provided by local municipalities or institutions (81.5 %) and 49 by national bodies (18.5 %);
- Nationwide data sets were assessed in usability on average better (1.57) than local data sets (1.93);

- HTML (30.5 %), PDF (29.1 %), XLS (10.9 %) and DOC (6.4 %) are the most used data formats on municipality and public authority web sites. Their usability was assessed as positive (score 1 or 2) in at least 64.7 % cases;
- The usability of data was evaluated similarly across observed regions beside those provided by nationwide institutions;
- The usability of data was assessed from three perspectives: citizen (265 evaluations), business (60) and public administration staff (58);
- The average usability was the best from citizen's point of view (1.86) and the worst from the business point of view (2.25), but most of respondents were rather citizens than business people, which might have impacted results;
- Currently, the citizens cannot see the difference in usability of open and non-open data unless there are particular applications available;
- The benefit from using data was not affected by the size of municipality population from the perspective of respondents, but those respondents did not need to be the actual residents in those municipalities.

The presented results are limited due to the scope of the survey. More details about opinions of users coming from regions and local communities should be investigated. Also the willingness of people to use tools based on open data and to interact online with their local representatives should be examined thoroughly (Office, 2011; Susha et al, 2015).

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Agriculture and Sustainability: a GIS Based Model to Appraise Incentive Policy

Salvatore Giuffrida[1], Filippo Gagliano[2], Grazia Napoli[3]

[1]Department of Civil Engineer and Architecture, University of Catania, Italy,
e-mail: sgiuffri@dica.unict.it
[2]Department of Civil Engineer and Architecture, University of Catania, Italy,
e-mail: fmgagliano@gmail.com
[3]Department of Architecture, University of Palermo, Italy, e-mail: grazia.napoli@unipa.it

Abstract. Agriculture is the major form of protection of local identities and sustainability and one of the most fragile Italian economic sectors, exposed to fluctuations of the financial/economic crisis. As a consequence, boosting agricultural policies should integrate conflicting objectives connected to preservation and innovation, effectiveness/efficiency, and landscape features and job opportunities. Referring to a large land area located in the central part of Sicily (Italy) the paper proposes an assessment/planning pattern aimed at providing some axiological items and a specific algorithm able to appraise each specific land parcel, generating different strategies and selecting the best format of funding allocation. The pattern combines some WebGIS tools helpful for spatial analysis and management of the big data amount coming from the Landscape Regional Plan and the cadastral vector database. The general approach integrates monetary and qualitative features, as well as land estate and landscape values within a multidimensional pattern providing the quantitative conditions for supporting qualitative and sustainable development.

Keywords: agricultural policy, GIS, appraisal model, sustainability.

1 Introduction

Agriculture is an economic sector that has suffered the effects of the economic crisis and has been growing slower due to the change of the relationship between the State and the market, the increasing international competition, the uncertainty of the large-scale investments (INEA, 2011) and the modification of the Common Agricultural Policy (CAP) that, in 2007-2013, produced "a notable impact on the Italian and Sicilian agriculture caused by the decreasing attention to the Mediterranean agricultural products" (Regione Siciliana, 2008, p. 16). These difficulties are confirmed by the low availability of financial facilities in agriculture compared to other economic sectors (4.2% in the south, 2.5% in the centre-north Italy) (Caprara *et al*., 2010), and by the inability to accumulate economic wealth (over the decade 2000-2010 the added value increased by 2%).

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The preservation of the territory, in both its environmental and local dimensions, assumes the agricultural sector as a protection of economic wealth and a socio-economic whose activities have assumed a strategic importance because of the widespread a different demand in food and landscape. The new agricultural policy improves the nutritional behaviours by boosting the biological farms and promoting food education programmes (Pollan, 2007; Foer, 2010).

Despite the crisis, some important modifications have been improving the rural economic structure like the diffusion of environmental sustainability, the trust towards the responsibility of the local communities (European Commission 2011), a greater integration of land planning, economic investments and farm tourism reporting from 1998 to 2005 an increase of facilities of 58% in Italy and of 134% in Sicily (OSEAAS, 2007).

In this context, the change of the relationship among job, sustainability and territory is directed to the “degrowth, envelopes and maintenance" (Morin, 2012) and to some indications of the reformed CAP that invokes a strong public policy supporting those agricultural products whose production could not be guaranteed by the market, in order to prevent marginalisation, abandonment and degradation of the areas excluded from intensive farming and characterized by the permanence of fragile ecological and anthropic systems.

The conjugation of quantitative purposes (increase of 70% in agricultural products by 2050) to landscape and environmental sustainability (European Commission, 2010, pp. 2-3) asks for a global agricultural policy at a local scale which can be realized with a consistent amplification of a planning-oriented database and a territorial information system containing the data which allow to clearly and fairly appraise the economic, functional and landscape values of each territorial unit.

The Italian cadastre currently reports only dimensional and administrative data and the income from the land parcels, but its database is going to be improved with the development of orthophoto systems, cartographic modelling, GIS and WebGIS technologies to satisfy the ever-increasing demand for territorial data suitable for cognitive, appraising and planning purposes.

This study proposes a pattern for representing and appraising cadastral parcels; by applying GIS spatial calculation and by means of a great quantity of quality information, this model aims to improve tax equalisation and subsidy choice as well as to assess the redistributive effects of agricultural policy (Bernetti and Marinelli, 2010). These types of algorithms are common used to support the decision-making and improve the efficiency of multi-objective spatial planning (Cowen, 1988; Fotakis *et al*., 2012; Malczewski, 1999; Malczewski and Rinner, 2015).

2 Materials and methods

2.1 The cadastre: Information, Appraisal and Programming

The Cadastre has always represented the principal source of data used for an orderly representation of the territory and for planning economic activities. The

quantitative and qualitative increase of its technical information base allows, therefore, to consolidate its primary vocation, i.e. tax equalisation, through the integration of territorial policies into economic planning (Coletta *et al*., 2009; Rizzo, 1986) within the sustainable development. Sustainability is a concept that encompasses a plethora of definitions (Trovato, 2012), but it tightly focuses on local development, which involves anthropological and landscape dimensions, and this leads to reconsider the relationship between global capital and income accumulated/provided from the social and territorial macro-system.

Assuming a parcel[1] as the starting point, this research proposes to widen the cadastral database by integrating the economic and physical quantitative data with the aesthetic and qualitative data (geographical and landscape-related), so as to develop a territorial profile of each parcel through spatial calculation which is also suitable for the evaluation purpose. The new database can support the appraisal of the market values from the perspective of a cadastre founded on both incomes and values, for adjusting "the fiscal imposition to the asset recovery so that it can contribute to attenuate the effects of the crises and the speculative activities" (Rizzo, 2010), especially when the real estate becomes object of over-accumulation of capital with the aim of profiting from the differential market value.

The basic idea of this study is that public institutions can conduct virtuous hoarding activity by supporting the sustainable agricultural policies that raise the social value of the lands, thus promoting the traditional cultivation and making it competitive thanks to the introduction of innovations which not only increase the added value, but also tend to accumulate as farm improvement. The added value, defined as the difference between sales and purchases or as the remuneration of the productive factors (including amortization), "could be replaced in the fiscal survey by the social net product plus amortizations" (Rizzo, 2010, p. 146).

The recourse to GIS as a tool is consistent with the necessity to provide a value function containing the fundamental merit elements to have access to the incentive system as well as the territorial characteristics according to the policy for sustainable agriculture.

2.2 The GIS Model and the Methodology of the Georeferenced Cadastral Cartographic Database

The cartographic support has been achieved by integrating the necessary algorithms for a georeferenced cadastral cartographic database into a GIS; the object of the cartographic database and its spatial analyses apply the projection onto the geographic Cassini-Solder system, while territorial information is projected onto the geographic Gauss-Boaga system. In order to create a vector database, useful for accurate institutional calculation, the GIS database has been integrated with an algorithm using a rigorous methodology for the roto-translation (Di Filippo, 2004) (Figure 1). The methodology is divided in the following phases: 1. Acquisition of the cadastral cartography in numeric format; 2. Acquisition of the control points; 3.

[1] In the Italian land register, the parcel is a continuous part of land having the following characterizes: same owner, same type of cultivation and same ranking of productivity.

Translation from the plane coordinate system into the ellipsoidal coordinate system; 4. Transformation of the ellipsoidal coordinates; 5. Translation from the ellipsoidal coordinates into a new plane coordinate system (cartographic coordinates).

After correlating the two systems, the seven-parameter transformation is completed by calculating the translation parameters, two scale factors, the angular slide (S-band) and two rotation parameters according to the minimum quadratic difference. The algorithm runs using .XML file parameters and cadastral vector .CXF files, and creating a correlation between the *identification number* (*id*.) (cadastral code) of the parcel and the corresponding polygon, so that a geographic database in Shape format is developed (http://shapelib.maptools.org).

The database is built on the base of the *id*., by importing the cadastral data of the parcels following relational functions; besides, the fields *sheet* and *parcel* have been unified to build a specific field (KEY) and obtain a spatial join to the georeferenced cadastral map.

2.3 The Evaluation Model and the Spreadsheet

The proposed model is applied to a portion of land (Municipality of Piazza Armerina, Sicily, Italy) constituted by 31,254 parcels whose value has been represented from four points of view, 1. Landscape, 2. Environment, 3. Economy, 4. Functions. Each criterion is specified by indicators provided by a database that applies the spatial computation functions of the GIS and works out the criteria values by implementing specific utility functions.

The scores are assigned in an adimensional scale, ranging from 1 to 5, to each parcel, identified and described in quantitative and qualitative terms. The scores are positive when the characteristic constitutes an economic-monetary, functional, landscape or environmental value, and negative when it constitutes a disvalue (i.e. hydrogeological risk, high fire risk, etc.) (Table 1). The spatial analysis functions turn land characteristics into value function parameters. The relationship between characteristic and score is expressed by a utility function that associates the general value k – obtained by aggregating the scores by means of a Work Breakdown Structure – to each cadastral parcel.

$$k = \sum_i k_i' \lambda_i' . \tag{1}$$

where: (i = 1, 2, 3, 4), k is the overall value of each parcel, k_i' is the value of criterion i (k_1' = landscape, k_2' = environment, k_3' = economy, k_4' = functions), k_{j_i}'' is the weight expressing the importance of criterion j compared to first-level criteria;

$$k_i' = \sum_{j_i} k_{j_i}'' \lambda_{j_i}'' \tag{2}$$

where (j_1 = 1, 2,…, 6), (j_2 = 1, 2,…, 5), (j_3 = 1, 2,…, 4), (j_4 = 1, 2, 3), k_{j_i}'' is the value of subcriterion j of criterion i, λ_{j_i}'' is the weight defining the importance of subcriterion j – belonging to criterion i – compared to second-level criteria.

Table 1. Part of the evaluation spreadsheet model. Our processing on data provided by the Land Registry Office and Forestry Corps of the Sicilian Region – Forestry Informatin System, Guidelines of the Regional Territorial Landscape Plan (Superintendence and DAU, 2008).

code	sheet	parcel	municipality	parcel code	cultivation type	ranking	hectare	are	centiare	rental income	agricultural income	owner code	variation code	area (m²)	code part 1	cultivation type of part 1	ranking part 1	hectare parte 1	are part 1	centiare part 1	area (m²) part 1
28784	230	118 T		419608	36	3	0	22	50	5,23	3,49	32994		2228							
28785	230	61 T		419551	993	0	1	21	82	25,67	15,52	0	26A	12768							
28786	232	53 T		419735	1	4	0	75	50	11,7	3,9	0	DEN	7506							
28787	265	10 T		425109	993	0	0	27	0	19,93	9,76	0	26A	2705	AA	36	2	0	11	26	1126
28788	214	469 T		416203	29	2	0	37	14	32,61	13,43	49571	FRZ	3678							
28789	121	246 T		383845	74	4	0	41	60	10,74	8,59	38635		4083							
28790	123	721 T		385228	91	3	0	6	40	0,66	0,2	31212	FRZ	640							
28791	169	85 T		404034	91	2	0	7	26	0,94	0,37	0	26A	758							
28792	277	228 T		427162	1	2	0	14	76	7,62	1,52	0	26A	1412	AA	36	1	0	4	61	461
28793	189	34 T		411573	74	3	0	23	20	8,39	4,79	30947		2237							
28794	219	275 T		416976	993	0	0	69	90	9,73	3,61	0	26A	6883							
28795	222	116 T		417864	993	0	0	99	80	22,31	5,15	0	26A	9939	AA	91	2	0	26	75	2675

					landscape							environment					economy				functions		
					0,1	0,2	0,1	0,2	0,2	0,2	0,2	0,2	0,4	0,1	0,1	0,25	0,25	0,2	0,3	0,2	0,4	0,4
					0,07	0,14	0,07	0,14	0,14	0,14	0,02	0,02	0,04	0,01	0,01	0,03	0,03	0,02	0,03	0,02	0,04	0,04
code	sheet	parcel	municipality	parcel code	geology	plants	forestry	river	building of archi-tectural interest archeologic basin	geological risk	land use risk	forest fire (summer)	forest fire (winter)	road system constraint	rental income	agricultural income	average agricultural value market value/m²	forest fire	land use	slope	
28784	230	118 T		419608	3,0	3,0	3,7	2,7	5,0	-1,0	0,0	0,0	0,0	0,0	0,0	0,0	1,0	2,5	2,3	3,8	1,4	
28785	230	61 T		419551	3,0	3,0	3,9	1,8	5,0	-1,0	0,0	0,0	1,0	0,0	0,0	0,0	1,0	2,3	2,0			
28786	232	53 T		419735	3,0	3,0	1,2	3,8	5,0	-1,0	0,0	0,0	0,0	0,0	0,0	0,0	1,0	2,1	1,2	2,7	1,2	
28787	265	10 T		425109	3,0	3,0	3,0	2,0	5,0	-1,0	0,0	0,0	0,0	0,0	0,0	0,0	1,0	3,6	3,1	4,5	1,5	
28788	214	469 T		416203	3,0	3,0	3,8	2,8	5,0	-0,8	0,0	0,0	0,0	0,0	0,0	0,0	5,0	3,8	3,1	4,5	2,7	
28789	121	246 T		383845	3,0	3,0	3,8	7,7	5,0	-3,0	-2,1	5,0	0,0	0,0	0,0	0,0	1,0	2,6	2,6	3,2	2,2	
28790	123	721 T		385228	3,0	3,0	4,0	3,0	5,0	-3,1	-3,0	1,0	0,0	-4,0	0,0	0,0	1,0	1,7	0,7	0,8	1,8	
28791	169	85 T		404034	1,0	3,0	4,0	5,0	5,0	-2,0	-2,0	5,0	1,0	0,0	0,0	0,0	2,5	1,9	1,1	0,8	1,7	
28792	277	228 T		427162	3,0	3,0	4,8	2,0	5,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	5,0	3,3	1,9	2,7	1,8	
28793	189	34 T		411573	2,5	3,0	0,6	5,0	5,0	-1,5	-1,2	2,0	1,0	0,0	0,0	0,0	1,0	3,0	2,6	3,2	1,9	
28794	219	275 T		416976	3,0	3,0	3,1	3,4	5,0	-1,0	-0,9	2,0	0,0	0,0	-3,0	0,0	0,0	5,0	2,0	1,2		
28795	222	116 T		417864	2,5	3,0	0,2	5,0	5,0	-2,8	-2,0	0,0	5,0	0,0	0,0	0,0	0,0	2,0	2,5	1,2	1,2	1,3

The economic criterion is based on the cadastral incomes (landowners and firms), the agricultural standard value and market value, productivity, acclivity, location. The pattern integrates spatial and appraisal calculation functions by a specific algorithm allowing both the numerical and the graphical implementation, and recording both the cartographic changes in the charts, and the numerical changes in the mapping. A WebGIS interface allows displaying the distribution of the parcels boosted according to a fixed budget and a specific strategy (Sani and Rinner, 2011; Torre, 2007).

2.4 Incentive Policy

The incentive policy takes into account sustainability principles as declined by integrating firm economic performances in local identity and culture. In the Enna

district low urbanization, demographic drop, intense migration flowing towards external labour markets, a weak economic system mostly depending on agriculture and high unemployment rate on the one hand, and the vitality of traditional handicrafts and the construction sector on the other, should be of great interest to an incentive policy for the creation of added value, diversification in household consumption and improvement of life quality.

In Sicily, the CAP is inspired by the European support strategy that intends to integrate market, local rural development, sustainability and innovation. With reference to some key thematic areas – economy of the agri-food sector, environment, rural economy and population – the development programs individuate four axis: 1. Improving the competitiveness of the agricultural and forestry sector; 2. Improving the environment and the countryside; 3. Quality of life in rural areas and diversification of the rural economy; 4. Leader, (ENRD, 2007).

The proposed pattern is a decision-making support helpful for determining the financial requirement of the firms involved in the incentive program. Measure 112 of CAP 2007-2013 is supposed to be applied: it concerns the renewal process of the entrepreneurial culture in terms of economic actors and farm competitiveness. The overall financial envelope of the measure is 90 mln € and is conditional upon the execution of at least another investment measure among the following: a) Modernisation of agricultural holdings (M.121); b) Improvement of the economic value of forests (M.122); c) First afforestation of agricultural land (M.221); d) Diversification into non-agricultural activities (M.311).

The financeable amount, assumed as a base for determining the requirement, is established by adopting the current practices among local operators, that is, the standard amount of 40,000 euros (M.112) plus further 60,000 euros for any additional measure. The access to the funding depends on the dimension of the farm that has to correspond to 10 ESUs (Economic Size Unit), reduced to 8 ESUs in case of disadvantaged areas (e.g. where the municipality of Piazza Armerina is located).

3 Results of Appraisal and Programmatic Indications

The economic appraisal and spatial calculation of the area have shown the spatial distribution of the parcels which most deserve an incentive based on a hypothetical budget. The selection is made on the following algorithm:

$$\forall p \exists f_1(p) = k : k \geq g_W;\ 1 \leq k \leq 5;\ \sum_{i}^{n} f_2(p_i) = W;\ (n = 31.254) \tag{3}$$

where p is the generic parcel selected if the value k overcomes the threshold g_w; the threshold is set so that the potential funding sum of all the selected parcels will be equal to the total budget W (Fig. 1)

Eight different strategies have been hypothesized; each of them is defined by a specific weight system λ_j (respecting the constraint $\sum_j \lambda_j = 1$) placing primary importance on two of the four different qualitative dimensions (Landscape,

Environment, Economy and Functions) (strategies 1-4) or on each dimension (strategies 5-8) (Table 2).

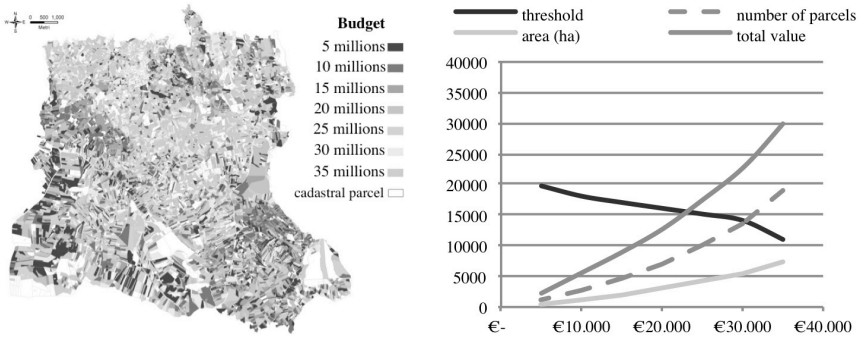

Fig. 1. Funding distribution of the budget increasing from EUR 5 to 35 million.

Table 2. Weight system of the eight strategies.

	Strategies							
Criteria	1	2	3	4	5	6	7	8
Landscape	0,1	0,5	0,1	0,4	0,7	0,1	0,1	0,1
Environment	0,1	0,1	0,4	0,1	0,1	0,7	0,1	0,1
Economy	0,5	0,3	0,4	0,1	0,1	0,1	0,7	0,1
Functions	0,3	0,1	0,1	0,4	0,1	0,1	0,1	0,7

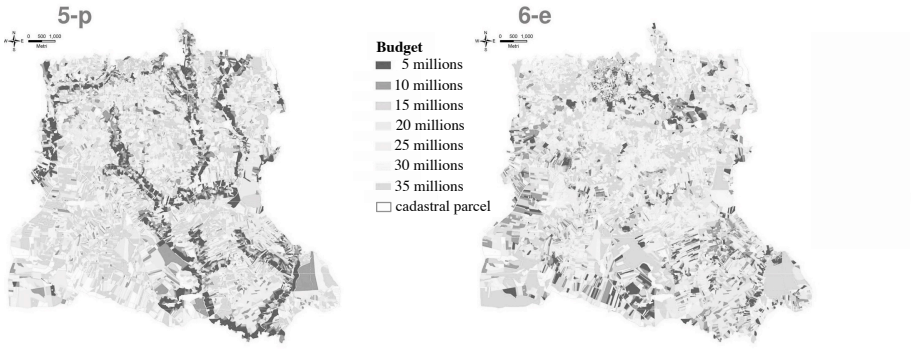

Fig. 2. Distribution of the parcels selected according to the budget and strategies 5 and 6.

The varied results produced by the different strategies raise issue of fairness in funding (Fig. 2). To this end, every strategy should analyse the relationships among the increasing budget and: the number of the selected parcels; the area receiving funding (index of efficient and fair funding allocation); the threshold level which is reduced for selecting the parcels (indicating the relationship between funding amount and quality of the selected parcels); the overall evaluation (index summing all the scores of the selected parcels).

These characteristics are normalized on a scale from 0 to 2 (Tab. 3, Fig. 3). On the same budget one strategy is preferred if: a greater number of parcels and a greater area are financed; a higher total value is obtained (when the best parcels or a much greater number of less valuable parcels are financed); the same number of parcels is selected on the same budget but a higher threshold is imposed (index of higher-quality parcels along the main criteria of a specific strategy).

Table 3. Weight system of the eight strategies.

strategy	location threshold	slope threshold	width threshold	location parcel	slope parcel	width parcel	location area	slope area	width area	location value	slope value	width value
str 1	1,94	-0,09	1,27	6793	4,02	18134	2563	4,76	7222	14941	2,69	33002
str 2	1,65	-0,06	0,69	6556	3,21	16963	2540	2,84	7118	11818	2,40	26922
str 3	1,54	-0,10	1,12	6948	5,28	18178	2383	5,09	7222	11989	3,50	26212
str 4	1,65	-0,07	0,91	8850	1,67	17868	3953	1,26	6759	17013	1,18	28964
str 5	1,46	-0,04	0,44	7686	1,53	16498	3740	1,04	6562	12595	1,13	23687
str 6	1,12	-0,12	1,02	9113	1,68	18233	3470	2,08	7122	11943	1,13	18869
str 7	1,98	-0,09	1,37	6246	5,02	18112	2007	5,15	7242	13888	3,12	32954
str 8	1,83	-0,11	1,78	9165	1,68	18200	4016	1,20	6712	20763	1,02	32536

strategy	location threshold	slope threshold	width threshold	location parcel	slope parcel	width parcel	location area	slope area	width area	location value	slope value	width value
str 1	1,91	1,08	1,23	0,37	1,33	1,89	0,55	1,81	1,94	0,70	1,34	2,00
str 2	1,23	0,38	0,37	0,21	0,90	0,54	0,53	0,88	1,64	0,00	1,11	1,14
str 3	0,99	1,35	1,02	0,48	2,00	1,94	0,37	1,97	1,94	0,04	2,00	1,04
str 4	1,25	0,74	0,71	1,78	0,08	1,58	1,94	0,11	0,58	1,16	0,13	1,43
str 5	0,80	0,00	0,00	0,99	0,00	0,00	1,73	0,00	0,00	0,17	0,09	0,68
str 6	0,00	2,00	0,86	1,96	0,08	2,00	1,46	0,51	1,65	0,03	0,08	0,00
str 7	2,00	1,26	1,39	0,00	1,86	1,86	0,00	2,00	2,00	0,46	1,69	1,99
str 8	1,65	1,74	2,00	2,00	0,08	1,96	2,00	0,08	0,44	2,00	0,00	1,93

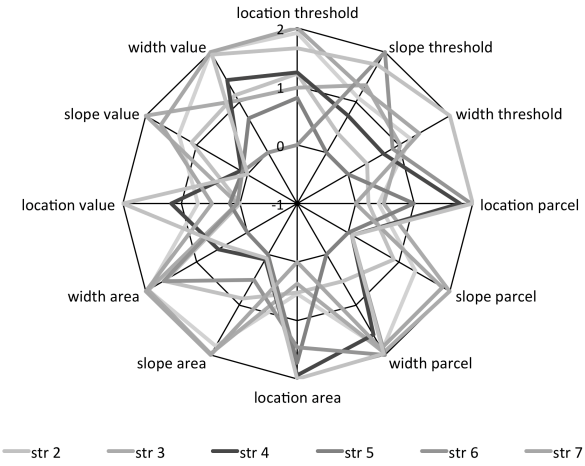

Fig. 3. Evaluation of the strategies according to the efficiency/effectiveness of the budget allocation

The model allows a further evaluation concerning the distribution of the financed land units with reference to land qualification. The whole financed parcels are overlapped with eight *qualified sectors* (for a budget of EUR 20 million) implementing one by one the eight strategies (64 combinations) and selecting the parcels inside (dark grey) and outside (light grey) the *sector*: the indexes of effectiveness of each strategy can be achieved by connecting the area of each *sector with* the whole financed area and the financed area inside the *sector* (Fig. 4).

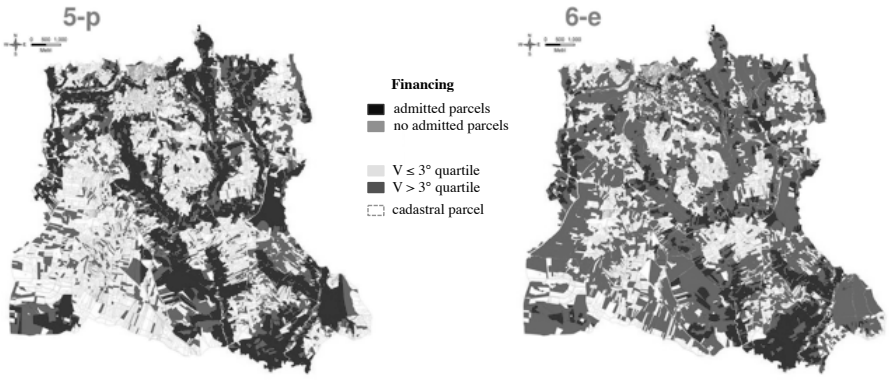

Fig. 4. Effectiveness evaluation of strategies 5 and 6 with reference to the qualified area

4 Conclusion

The proposed model allows testing how a representation and evaluation model (through functions of spatial calculation and economic appraisal) can address the incentive policy of the agricultural sector.

The results underlined the conditions, which justify and prefer a policy aimed at encouraging lands with greater landscape value and lower productivity. A coherent economic and land planning in agriculture imposes itself with some urgency and asks for a methodology of analytical representation and evaluation of the territory which assumes minimum units of study described by detailed spatial information, and accurately stored and managed by spatial informative systems.

The paper has also underlined some criticalities of these procedures, due to very poor standardised geo-spatial data; thus, a specialist competence is required for building an evaluation database. Potentially, this model can be developed by overcoming the additive approach and pushing the artificial intelligence to represent complex relationships.

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Vector Space Modeling for Aggregate and Industry Sectors in Kuwait

Kevin Lawler[1]

[1]Central Statistical Bureau: State of Kuwait/ U.N.D.P

Abstract. Trend growth in total factor productivity (TFP) is unobserved; it evolves continually over time. That assumption is inherent in the use of the Hodrick-Prescott or other bandpass filters to extract trends. Similarly, the Kalman filter/unobserved-components approach assumes that changes in the trend growth rate are normally distributed. In fact, some changes to the trend growth rate of total factor productivity are normally distributed but some may not be, especially in the presence of random technology shocks. The latter distribution may be asymmetric with large outliers. Allowing for those outliers, the estimated trend growth rate changes only infrequently. A strength of the paper is that aggregate trends in TFP are presented, but also industry disaggregated trends estimated by the same techniques.

Keywords: Solow Residual, total factor productivity, univariate filters

1 Introduction

This argument here records the development of a Kalman Filter and other filters to extract trends in TFP for the Kuwait economy since 1970. The Kalman filter was used initially on aggregate trends in Kuwait's GDP. Later the same procedures were used for extracting TFP in Kuwait agricultural, health /education, manufacturing, finance, construction, wholesale and other service sectors. In this way total factor productivity is therefore disaggregated for Kuwait allowing informed policy debate.

To begin trend and cyclical components movements in the time series are extractedidentifying key moments and turning points in the time series on economic growth for Kuwait. The relative performance of the Kalman Filter process is then assessed with respect to other filters such as the Hodrick –Prescott (HP) procedure. The filters were run against each other for several diverse sectors of the Kuwait economy. The relative performance of the filters are then compared to predicted changes in sector value added as delivered by an estimated Solow –growth /Cobb/Douglas production function. Generally all filters performed in roughly uniform terms with regards to directions of change but the Kalman delivers more efficiently on in picking earlier changes in shift factors in trends of TFP.

The filters do a broadly similar job in the sector analyses (op. cit.((Appendices1-3)). The tracking movements for the filters are depicted clearly here. In the future these filters are to be used to develop a composite leading indicator for Kuwait by

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incorporating a Markov procedure to pick early, as distinct from coincident movements in production time series. Agriculture is currently a heavily subsidized sector in Kuwait to engender a strategic shift to national food security. Trends in TFP are therefore vital to monitor so that future agricultural programs can be underpinned with a reliable statistical foundation. All the sectoral analyses indicate generational declines in aggregate and industrial/sector TFP, which are consistent with the literature and other independent studies. In the past high oil prices compensated for this decline in productivity, however, with lower global oil prices Kuwait is likely to move towards enhanced labour intensity based on migrant labour flows from poorer nations in south Asia. The regression analysis in (Appendix 3) demonstrates the significance of TFP on Kuwait growth experience since the 1970. This also indicates from that labours share in aggregate production the (Solow coefficient, a) has been increasing since the 1990's. Given lower real global oil prices, Kuwait may increase its labour intensity profiles in agriculture and other activities. Moreover further analysis of the long-term trends in Kuwait's terms of trade may be an additional factor in stimulating this this process.

However, labour productivity fell in the economic crisis of late/early 2008/9, making it more difficult to estimate the trend pace of productivity growth. When the present crisis ends, labour productivity should improve. However this depends in part on the future rate of growth of gross fixed capital formation, and also depends on future growth of total factor productivity (TFP), that is, the "Solow residual" or "technical progress." Several methods for extracting the trend component of total factor productivity are reviewed, to find a procedure that performs efficiently when evaluating trend data and may be used as a guide to the current – and possibly future – trend in the Kuwait economy's productive potential.

A state-space model (Kalman filter Appendix 1) of aggregate/sector output is developed which justifies the use of univariate filters to estimate the trend component of the Solow residual (Appendix 3) The discussion then turns to comment on the use of other linear uni -variate filters available for estimating trends. Appendix (2) depicts relative filters performance in all the sub-sectors investigated for the Kuwait economy since 1994. These results demonstrate a solid case for the use of uni-variate filters in agriculture and other sectors since they all track the calculated Solow Residual. (Appendix 3)

Of the linear filters, the Kalman filter works best in modeling TFP trends; however, none of the linear filters are fully adequate in modeling total factor productivity. The problem is that innovations creating shocks for trend growth of TFP are not normally distributed; and in particular, significant changes in trend productivity growth appear to occur only at infrequent intervals. The state-space/Kalman filter approach instead assumes normally distributed variations to trend growth. Similarly, the Hodrick-Prescott smoothing parameter implicitly assumes a path for trend TFP that is differentiable and whose growth rate evolves continuously.

Given estimates of the capital stock, labor quality, and the equilibrium labor share, calculating trend labor productivity amounts to calculating the trend in the Solow residual. This is done following (French, M, W2001) as follows:

output (Q) is the product of trend (Q_{trend}) and gap (Q_{cycle}).

Hours supplied (H) is the product of trend hours supplied (H_{trend}) and a stationary cyclical term (H_{cycle}).

Trend labor (L_{trend}) is the product of trend hours supplied (H_{trend}) and the quality of each labor hour (L_{qual}).

A two-factor Cobb-Douglas production function holds in equilibrium.

The Solow residual (S) includes cyclical factors as well as trends in total factor productivity (TFP_{trend}).

factor productivity (TFPtrend).
*K

These five definitions are expressed in equations 1 - 5:

(1) $Q = Q_{trend} * Q_{cycle}$

(2) $H = H_{trend} * H_{cycle}$

(3) $L_{trend} = H_{trend} * L_{qual}$

(4) $Q_{trend} = TFP_{trend} * L_{trend} * K^{1-}$

(4a) $Q = s * (H * L_{qual}) * K^{1-}$

The observed Solow residual is calculated by inverting equation 4a. Equations 1 - 4a imply the following relationship between the observed Solow residual and the underlying trend in total factor productivity:

(5) $S = [Q_{cycle} / H_{cycle}] * TFP$

The objective is to extract TFP_{trend}, the unobserved trend in total factor productivity shown in equation 5, from the Solow residual.

2 Methods and Models

2.1 Univariate Methods of Extracting Trend

Peak-to-peak interpolation was common in the 1960s (DeLong 1988). From the early to mid-1970s, the deterministic trend was commonly used in describing labor

productivity or trend output. From 1987 to 1992, several authors began to decompose the sources of trend output growth using aggregate production functions; in essence, the problem shifted from estimating trend labor productivity to estimating trend total factor productivity. In the 1990s and thereafter, trends in output and productivity have frequently been estimated using a stochastic-trend model.

The peak-to-peak method has the advantage of simplicity. However, it relies on the questionable assumption that the economy operates at the same level of excess demand at all cyclical peaks. For long expansions, this assumption is harmless, and the procedure works well but for short term movements or, expansions or, periods shortly after downturns, it may be spurious.

An Andrews (D, 1993) test for a significant shift in the growth of total factor productivity would indicate a break in average growth, however, a methodology is required that accounts for the possibility of such changes. Three such methodologies are the Hodrick-Prescott (H-P) filter, Christiano's bandpass filter, and trend-cycle decomposition with state-space modeling and the Kalman filter.

2.2 Hodrick-Prescott Filter

The Hodrick-Prescott filter estimates trend by smoothing (Appendix 1) – in effect, by taking a weighted moving average of the original series, where the moving average is symmetric and centered. In practice, one must choose how smooth the resulting trend should be. In some applications, however, researchers have used a parameters larger values; as the smoothness parameter becomes very large, the H-P filter constructs a linear trend (Cogley,T. 1995).The Hodrick-Prescott filter is quite simple to implement; however, it also has potentially large disadvantages. Unfortunately, the HP filter is optimal only under two fairly restrictive assumptions. First, the data must, a priori, be known to have an I(2) trend. Otherwise, the filter generates shifts in trend growth rates when they are not present in the raw data. If instead there are only one shot permanent shocks to the level of trend, or a constant (split) trend growth rate, or both – the H-P filter distorts the cyclical properties and the higher moments of the data in a significant way. If one is not committed to a time-varying trend growth rate, other approaches are preferable to H-P, because they allow for the possibility of a fixed (split) trend growth rate.Second, the H-P filter is optimal only if the cycle consists of white noise or, if the identical dynamic mechanism propagates changes in the trend growth rate and in the innovations to the business cycle component. Baxter, (1999) argues both are these conditions are not likely to be co-existing. Moreover, even the best alternatives to the H-P filter are unlikely to be optimal either, as misspecification is a virtual certainty.Another weakness of the H-P filter is, that in most published applications, the choice of the smoothness parameter typically has been arbitrary.

Uncertainty about an appropriate full-sample smoothing parameter is not the only problem in using the H-P filter. The filter does not possess a reliable method for determining the appropriate gain on new data points at the end of the sample, when the filter is no longer two-sided – a marked failure relative to the state-space/Kalman filter approach.

Hamilton argues (1986,), that the Kalman filter is the optimal one-sided filter, with optimal estimate of gain, for any process that linearly links the observed variables with state variables and exogenous and/or lagged dependent variables (i.e. a linear state-space process, with any order of integration). It is optimal among all filters, linear or non-linear, if in addition the state-space model's errors are Gaussian.

It is desirable that the distortions created by the H-P filter are small: if they are, its simplicity is a major recommendation. Furthermore, even if the H-P filter is sub-optimal, it is not clear that the alternatives are better – provided one assumes an I (2) trend a priori. Misspecification problems can make any approach to estimating trend sub-optimal – even the two purportedly superior filters, the Bandpass and Kalman filters.

2.3 Kalman filter / State-space Model

This approach uses historical data to estimate the share of the variance (of the Solow residual) to assign to trend rather than cycle (Appendix 1). In principle, the approach can also determine whether or not the I (2) component of trend is significantly different from zero – a major advantage over the H-P filter. In practice, the state-space/Kalman filter approach has an important disadvantage: its variance estimates are biased toward zero when the true variance is small but non-zero.

3 Conclusions

None of the linear filters produce a perfect solution.. The H-P and the bandpass filters yield similar results given that the "optimal" H-P smoothing parameter of, both filters impose I (2) swings on the TFP trend.

An awkward remaining problem is to find a structure for modeling trend in total factor productivity that captures random historical shift(s).Although linear filters fail to successfully model shifts in trend TFP growth, it may be possible to model such shifts with greater success using an alternative to linear filtering.

Hamilton's Markov-switching model (1996, ibid) offers such methodology.

Although trend TFP growth declined dramatically in the 2008/9, crisis there is no clear evidence of continuously evolving trend growth in total factor productivity – calling into question the usual stochastic trend models or the use of Hodrick-Prescott filtering.How can shifts in trend growth of TFP be extracted more quickly? By utilizing additional information to bear from other supply-side variables, such as labour-force/household - surveys labour – cohort analysis and participation rates. But these other supply-side variables feature normal innovations to trend growth whereas shift changes TFP exhibit non-normal innovations. This essay uses data from 1970 to 2012. Data for all variables used in the above analysis were taken from data available to the Kuwait (CSB).

Data on capital [GFCF] is currently being revised with a new methodology, however, quarterly capital stock data produced by CSB which can be interpolated to a quarterly frequency.

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Appendix 1

Filter tracking of TFP can be seen in the subsequent graphs along with the Kalman filter specification. The graphs and charts follow the discussion in the text. The CSB macro econometric general equilibrium model was used to estimate value –added per sector and in aggregate Initially the macro- economic aggregate picture is shown followed by agriculture and other sectors.

The Kalman state space model is given by

$$Y = F^T_t \theta_t + v_t , \quad v_t \sim N(0, V_t)$$
$$\theta_t = G_t * \theta_{t-1} + w_t , \quad w_t \sim N(0, W_t)$$

for $t = 1, \ldots, n$. The natrices F_t, G_t, V_t *and* W_t may depend on a parameter vector f. The initialization is given as

$\theta_0 \sim N(m_0, C_0)$

$$a_t = G_t m_{t-1} \tag{1}$$

$$R_t = G_t C_t - G^T_t + W_t \tag{2}$$

$$f_t = F^T_t \, a_t \tag{3}$$

$$Q_t = F^T_t R_t F_t + V_t \tag{4}$$

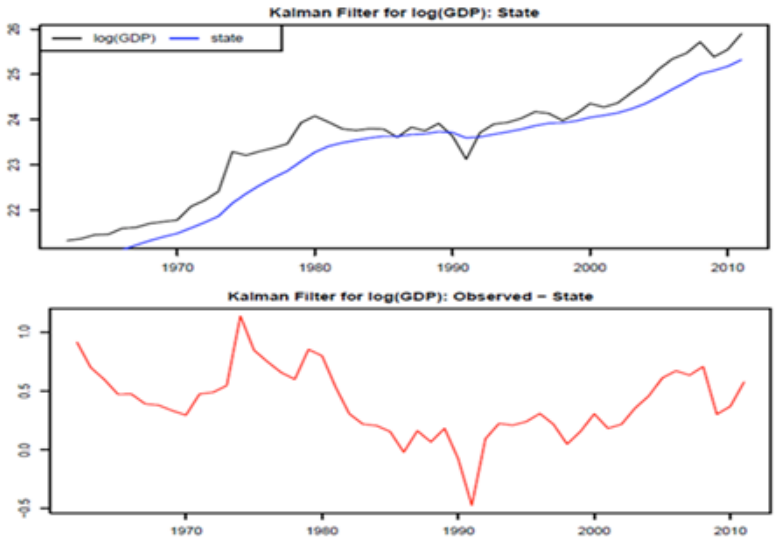
$$e_t = y_t - f_t \tag{5}$$

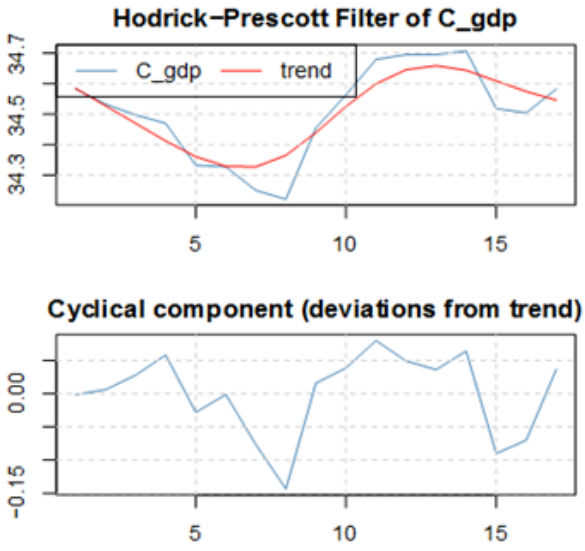
$$A_t = R_t F_t Q_t^{-1} \tag{6}$$

$$m_t = a_t + A_t e_t \tag{7}$$

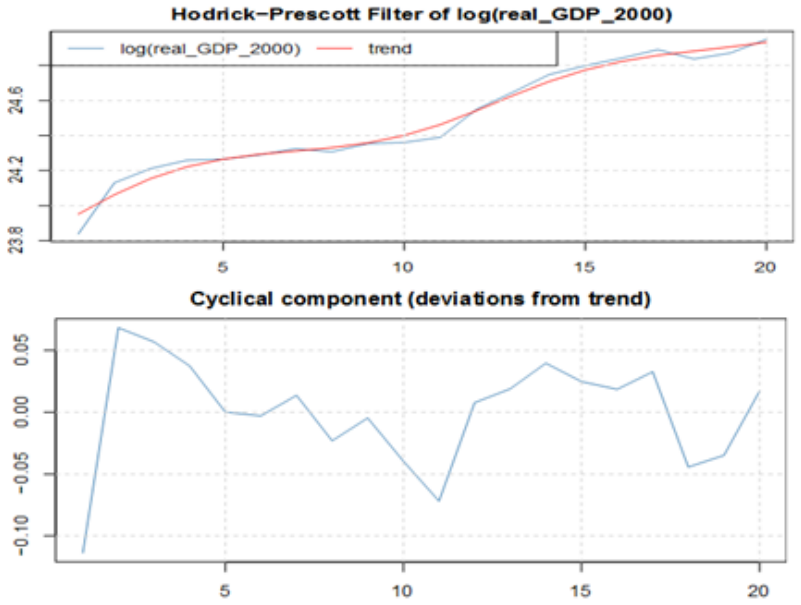
$$C_t = R_t - A_t Q_t A^T_t \tag{8}$$

Appendix 2. KALMAN Filter Specification/Performance

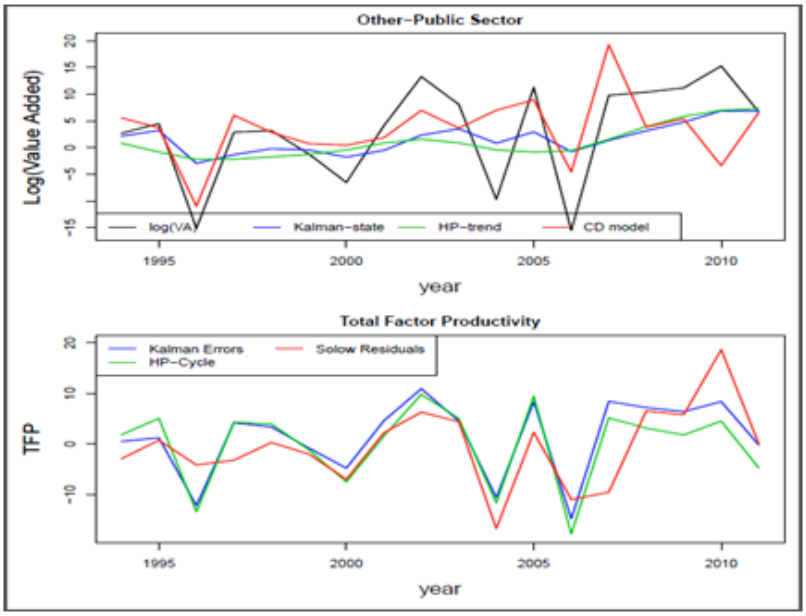


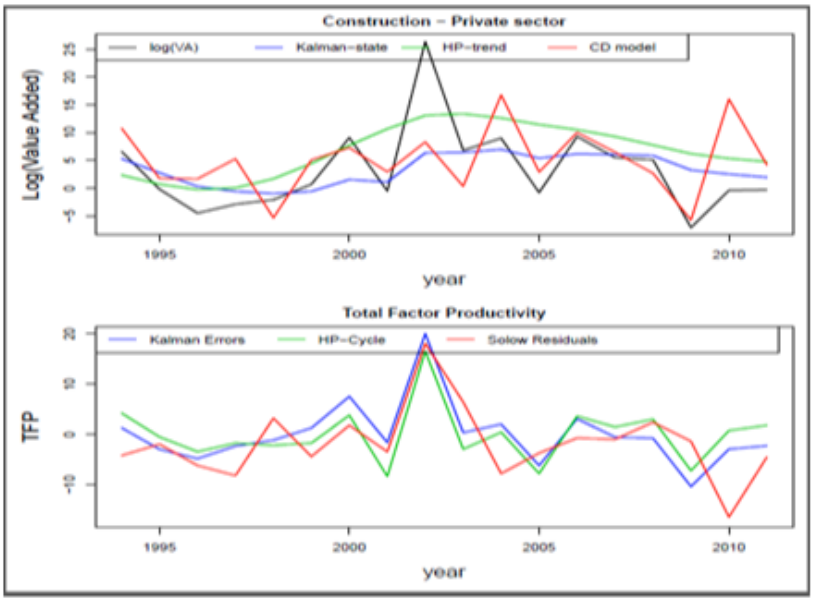


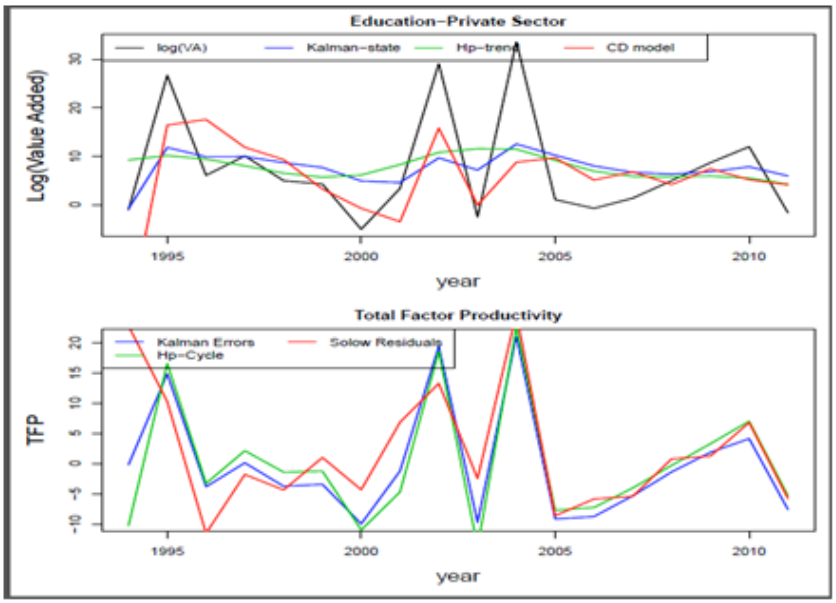

Aggriculture and Manufactoring Private Sector
log(VA)
Kalman−state
HP−trend
CD model
Log(Value Added)
year
Total Factor Productivity
Kalman Errors
HP−Cycle
Solow Residuals
TFP
year

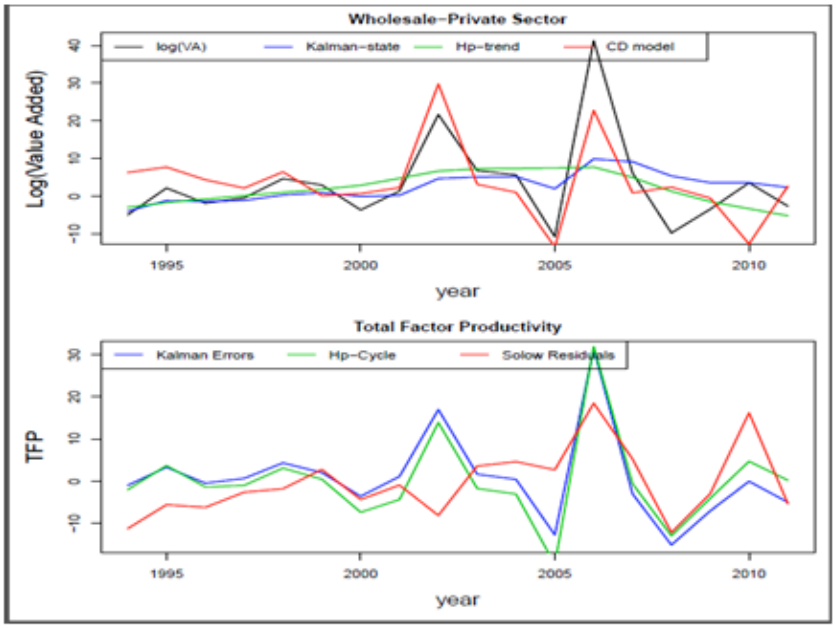

Hodrick−Prescott Filter of log(real_GDP_2000)
log(real_GDP_2000)
trend
Cyclical component (deviations from trend)

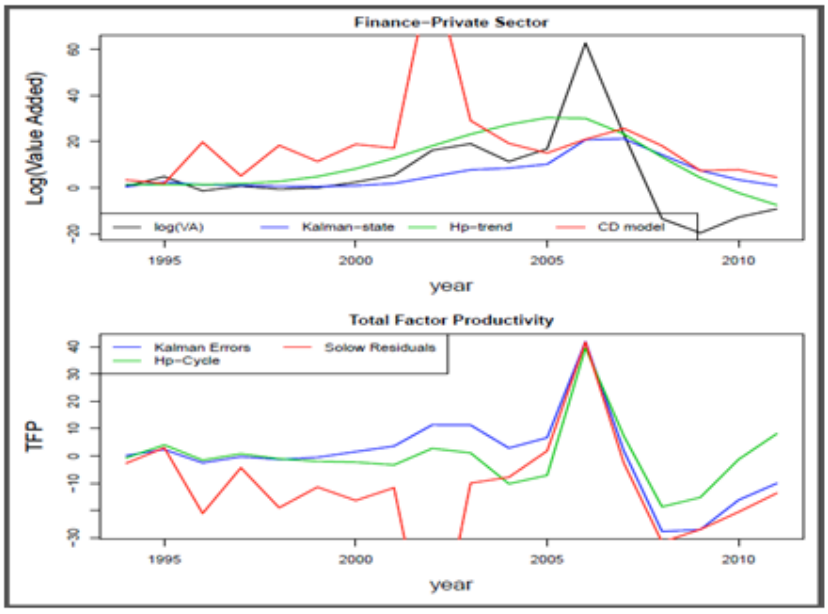
Appendix 3. KALMAN Filter Specification/Performance

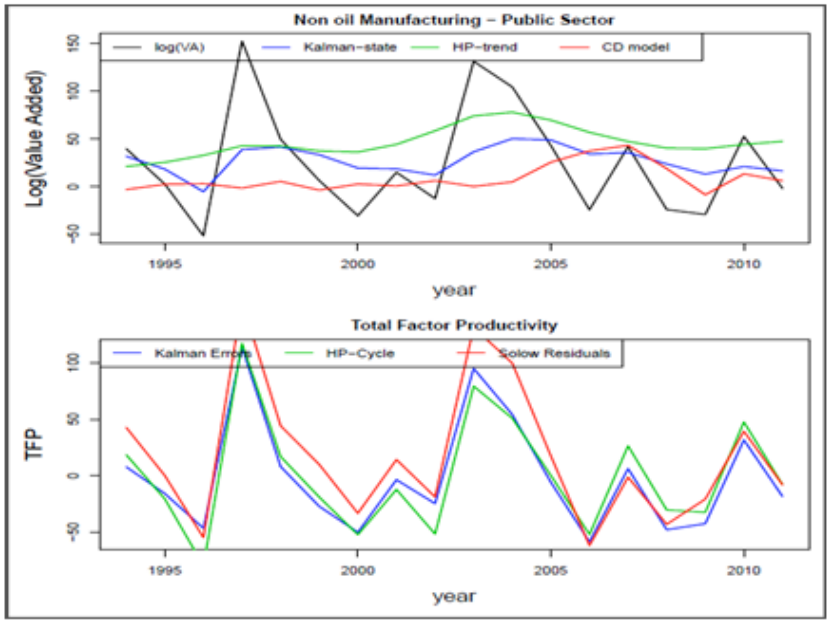


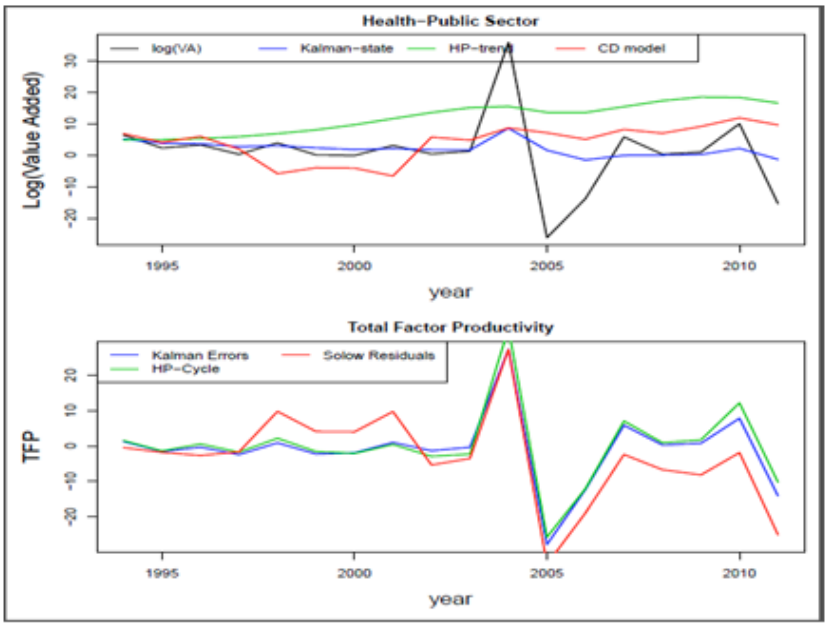


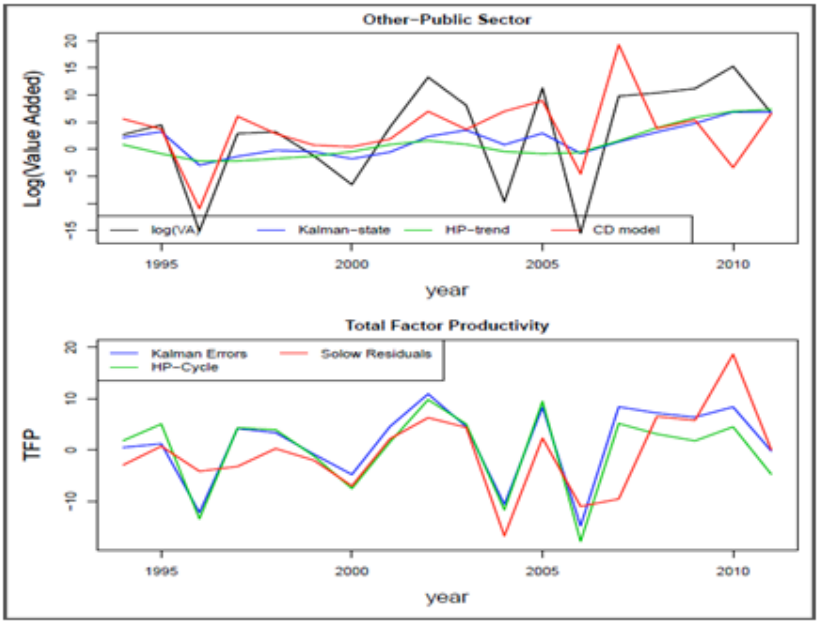

Education−Private Sector
log(VA)
Kalman−state
Hp−trend
CD model
Log(Value Added)
year
Total Factor Productivity
Kalman Errors
Solow Residuals
Hp−Cycle
TFP
year


Wholesale−Private Sector
log(VA)
Kalman−state
Hp−trend
CD model
Log(Value Added)
year
Total Factor Productivity
Kalman Errors
Hp−Cycle
Solow Residuals
TFP
year


Finance−Private Sector
Log(Value Added)
log(VA)
Kalman−state
Hp−trend
CD model
year
Total Factor Productivity
TFP
Kalman Errors
Hp−Cycle
Solow Residuals
year


Non oil Manufacturing − Public Sector
Log(Value Added)
log(VA)
Kalman−state
HP−trend
CD model
year
Total Factor Productivity
TFP
Kalman Errors
HP−Cycle
Solow Residuals
year


Health−Public Sector
log(VA)
Kalman−state
HP−trend
CD model
Log(Value Added)
year
Total Factor Productivity
Kalman Errors
Solow Residuals
HP−Cycle
TFP
year


Other−Public Sector
log(VA)
Kalman−state
HP−trend
CD model
Log(Value Added)
year
Total Factor Productivity
Kalman Errors
Solow Residuals
HP−Cycle
TFP
year


Transport and TeleCom−Private Sector
Log(Value Added)
log(VA)
Kalman−state
Hp−trend
CD model
1995
2000
2005
2010
year
Total Factor Productivity
TFP
Kalman Errors
Solow Residuals
Hp−Cycle
1995
2000
2005
2010
year

TFP : KUWAIT

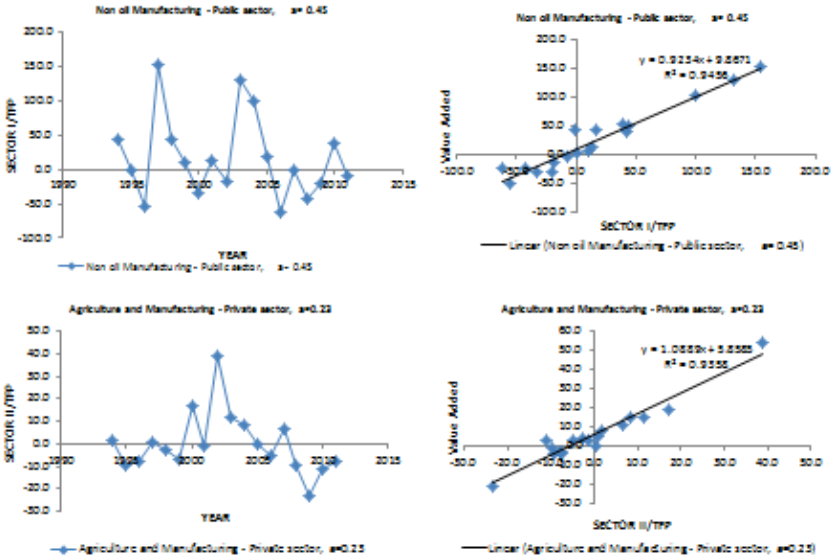
Non oil Manufacturing - Public sector,

Years	Solow TFP (CB model)	HP TFP	Kalman TFP
	42.68534601	18.556	7.854
1994	0.179935357	-20.407	-15.757
1995	-54.65206268	-79.537	-46.35
1996	154.0649482	117.099	113.748
1997	44.16960435	16.875	8.083
1998	10.01665231	-18.882	-27.038
1999	-33.13391644	-52.122	-49.954
2000	14.29425521	-12.157	-3.512
2001	-18.74551304	-51.506	-24.652
2002	131.2316966	79.362	94.886
2003	99.62677763	51.134	54.157
2004	17.5318669	0.709	-5.756
2005	-61.7162879	-51.249	-58.429
2006	-1.272943518	27.109	6.288
2007	-42.91362823	-29.86	-47.74
2008	-20.671624	-33.099	-42.369
2009	39.3444622	44.596	31.648
2010	-7.961910391	-14.317	-18.275
2011	17.33764773	7.696	7.509
Average			

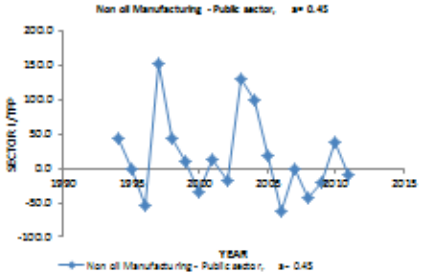
Agriculture and Manufacturing in Private Sector

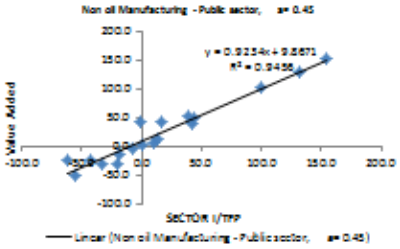
Years	Solow TFP (CB model)	HP TFP	Kalman TFP
1994	1.613037815	5.3626	1.6436
1995	-9.526766513	-2.2881	-3.8642
1996	-8.055867877	-4.3969	-4.1484
1997	1.079484003	2.5444	2.7754
1998	-2.792982654	-0.9527	1.1098
1999	-7.330555004	-11.5835	-4.6157
2000	17.11279081	5.6086	13.6654
2001	-1.355628604	-14.9659	-1.9194
2002	38.91408908	33.9059	39.6955
2003	11.51322096	-3.8687	0.3146
2004	8.494147488	0.3929	0.4101
2005	0.241308585	-9.6078	-11.7239
2006	-5.052162542	-2.6323	-7.4477
2007	6.778388337	9.1954	0.2815
2008	-9.304878478	-1.6278	-11.5276
2009	-23.1813143	-15.9761	-22.813
2010	-11.158464	9.0368	1.2693
2011	-7.552708095	1.8531	-4.9837
Average			

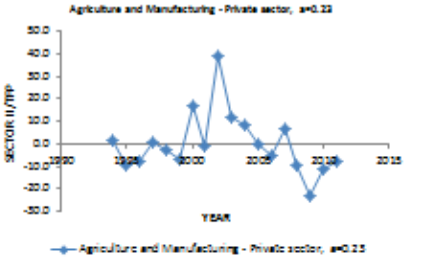
TFP :KUWAIT

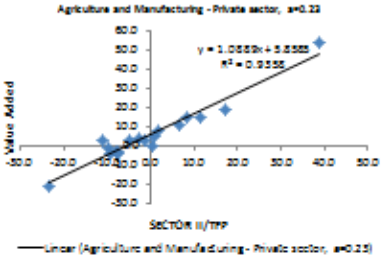


TFP :KUWAIT

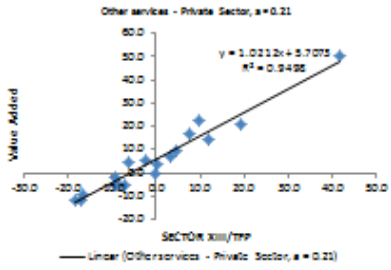


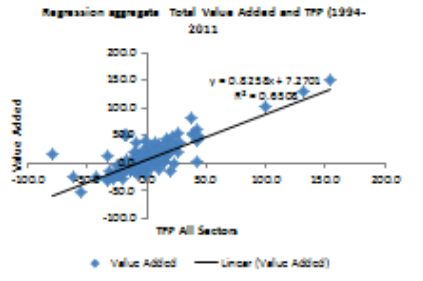


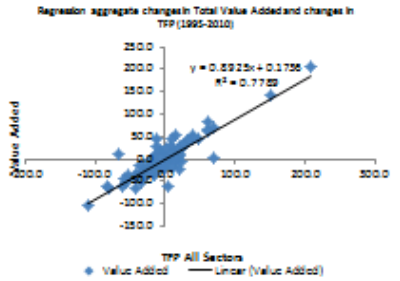




TFP :KUWAIT







Some Aspects of ICT Measurement: Comparative Analysis of E-Indexes

Kateryna Kononova[1]

[1]Department of Economic Cybernetics and Applied Economics, V.N. Karazin Kharkov National University, Kharkov, Ukraine, e-mail: kateryna.kononova@gmail.com

Abstract. There are more than twenty widely used e-indexes which are used to measure ICT Adoption all over the world. It might be a problem to choose ones to analyze the ICT dynamics or to compare the levels of ICT development in different regions of the world. So first the most common e-indexes were reviewed. Then the comparative analysis of the e-indexes structure has been done. The coherence of the e-indexes has been estimated using pair and rank correlation. The 'core' of the consolidated e-indexes was defined and the intersections of some e-indexes and the 'core' have been analyzed.

Keywords: E-Index, Pair and Rank Correlation, 'Core' of E-Indexes

1 Introduction

The composite e-indexes were developed to measure the levels of ICT Adopting in different countries all over the world. Nowadays there are more than twenty widely used e-indexes, among them the most popular are: Information Society Index (Dergachev, 2014), E-Readiness Index (Belova, 2011), Knowledge Economy Index (Batrakova, 2012), E-Government Development Index (Department of Economic and Social Affairs, United Nations, 2014), ICT Development Index (International Telecommunication Union, 2014), Digital Access Index (Market Information and Statistics Unit, 2003), Technology Achievement Index (Desai, 2002), Networked Readiness Index (Networked Readiness Index, 2015, Mikova, 2011, World Economic Forum, 2014), Digital Opportunity Index (International Telecommunication Union, 2010), ICT Opportunity Index (Nikitenkova, 2012), ICT Diffusion Index (Nikitenkova, 2012), Global Competitiveness Index (Global Competitiveness Index, 2015), Global Innovation Index (Cornell University, INSEAD, WIPO, 2014), Infostates (Sciadas, 2003).

The measurement of the ICT Adopting requires an actual data and comparable time series. But a lot of the e-indexes were estimated only a few times, some of them are difficult to verify.

So the aim of the study is comparative analysis of the e-indexes, assessment of their coherence, and determination key indicators of ICT Adopting.

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2 E-indexes Structure Analysis

Let's consider fourteen mentioned above e-indexes and carry out the comparative analysis of their structure. Eighty percent of e-indexes listed in Table 1 are calculated for more than 140 countries, although some of them (eg, ISI, ERI, and TAI) are less common.

Table 1. The list of the most widely used E-Indexes

Short name	Full name	Author	First publication	Number of countries
ISI	Information Society Index	IDC	1997	53
ERI	E-Readiness Index	EIU	2000	70
KEI	Knowledge Economy Index	WEF	2005	140
EGDI	E-Government Development Index	UNPAP	2002	182
IDI	ICT Development Index	ITU	2002	154
DAI	Digital Access Index	ITU	2003	178
TAI	Technology Achievement Index	UNDP	2001	72
NRI	Networked Readiness Index	WEF	2002	148
DOI	Digital Opportunity Index	ITU	2005	181
ICT-OI	ICT Opportunity Index	ITU	2005	183
ICT-DI	ICT Diffusion Index	UNCTAD	2006	180
GII	Global Innovation Index	INSEAD	2007	143
GCI	The Global Competitiveness Index	WEF	2004	144
IS	Infostates	ORBICOM	2003	183

Analysis of Fig. 1 shows that 80% of indexes are based on the 15 partial indicators as maximum (the partial indicators are got in the sub-indices which are grouped into final indexes).

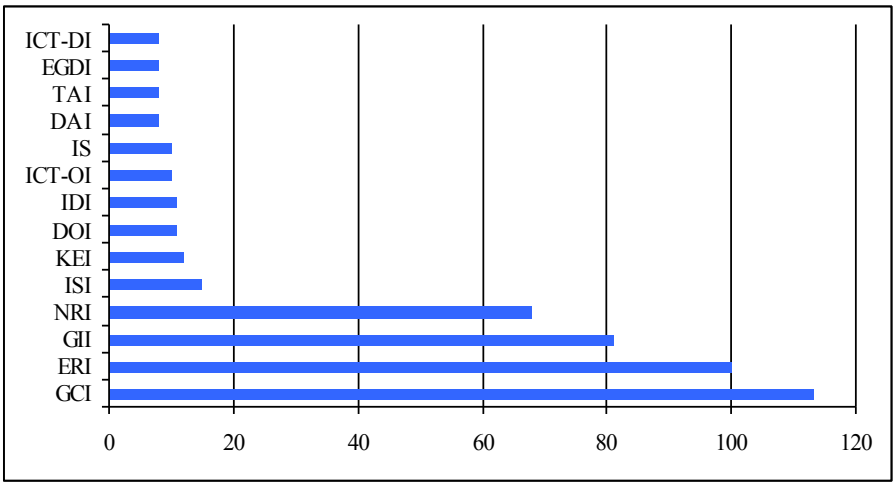

Fig. 1. The e-indexes ranked by the number of partial indicators

The simplicity of the e-indexes structure provides ease of their interpretation, at the same time the multidimensionality let to analyze a wide range of issues related to ICT Adopting.

The maximum number of partial indicators (113) has Global Competitiveness Index. E-Readiness Index contains more than one hundred partial indicators, but a complete estimation methodology of this index is not public. Also, a large number of indicators are included to Global Innovation Index – 81, and Networked Readiness Index – 68.

The minimum number of indicators among the indexes is eight, it consist four indexes: DAI, TAI, EGDI and ICT-DI. Only four indexes include greater than 60 indicators, the rest ten consist less than 30.

Considering the indexes in terms of their quality structure (Fig. 2), it should be noted that most of them are based on the hard data (statistical data from official sources, which have been obtained empirically and can be tested). However, there are a number of indexes with a lot of soft data (information obtained from statistical surveys and expert assessments, conducted by the authors of studies).

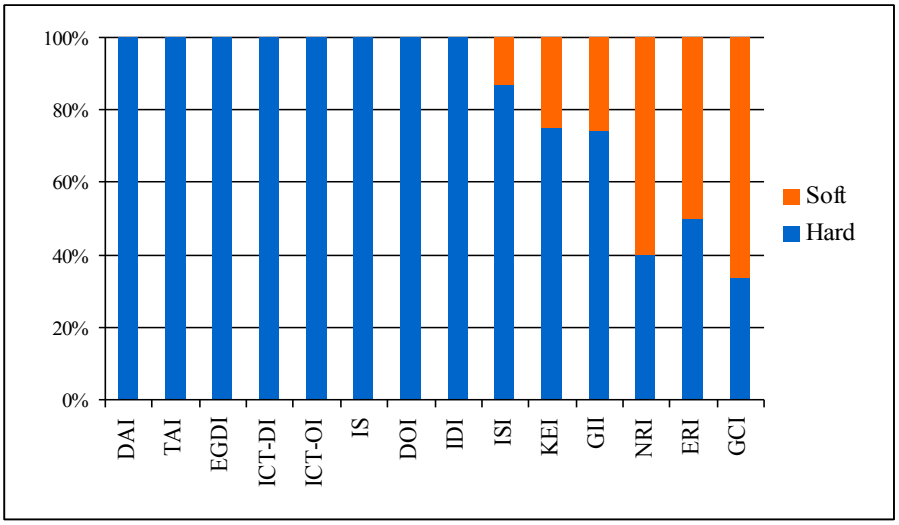

Fig. 2. The e-indexes ranked by hard and soft data in their structure

The analysis shows that eight of 14 indexes use only hard data (ICT-DI, EGDI, TAI, DAI, IS, ICT-OI, IDI, DOI), and only three indexes consist mainly soft data (NRI – 60.29%, ERI – 50% and GCI – 66.37%). Although the calculating methodologies of NRI (which is includes 68 partial indicators) and of GCI (which is includes 113 partial indicators) have a complete list of partial indicators with the references, but the developers do not give an access to own statistical surveys, and it is impossible to repeat their studies. The calculating methodology of ERI (which is includes 100 partial indicators) is not given in full, which also makes verifying the data impossible.

It is interesting to consider the share of ICT indicators in the total number of partial indicators (Fig. 3). At the early stages of ICT Adopting, the main focus was on the information infrastructure. Nowadays the number of indicators that are not directly related to the dissemination and use of ICT has increased because of the multidimensionality and complexity of the issues related to ICT Adopting.

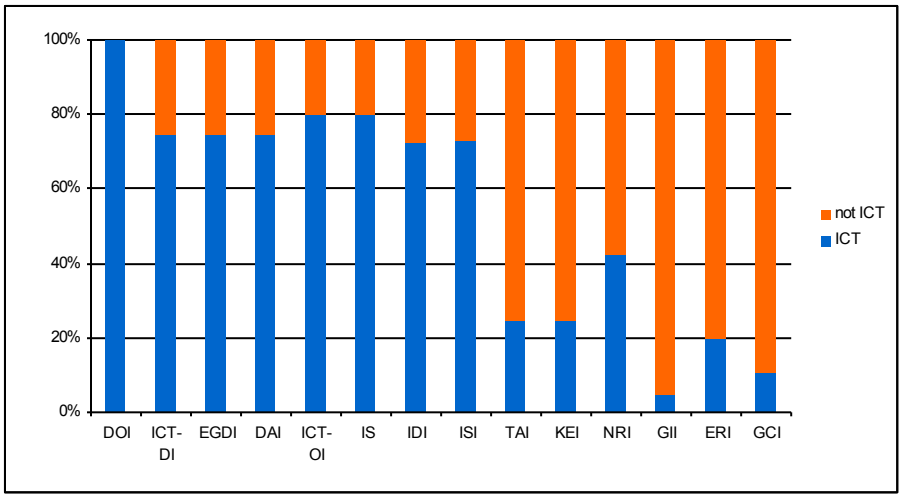

Fig. 3. The e-indexes by ICT and not ICT indicators in their structure

Only one (DOI) of the 14 analyzed composite e-indexes uses solely ICT-related partial indicators, the others combine them with socio-economic indicators. Six of e-indexes (GII, GCI, ERI, KEI, TAI, and NRI) contain more than half of indicators which are not related to ICT directly. This fact can be justified by the assumption that the success of ICT Adopting depends on indirect characteristics (eg, education) more than on the technological parameters.

3 E-indexes coherence

The next stage of the study was the coherence analysis of the e-indexes. Some of fourteen indexes mentioned above were evaluated only a few times. Also an important factor was the availability of data in the public domain. Therefore, only six indexes (KEI, IDI, EGDI, GII, NRI, and GCI) were selected for the further studies.

The paired correlation coefficients for the 96 countries in 2013 were evaluated (see Table 2). The analysis of Table 2 shows that there is a strong probability of linear dependence between the e-indexes (the confidence level is not less than 95%).

Table 2. The paired correlation coefficients

Indexes	KEI	GII	IDI	EGDI	NRI	GCI
KEI	1	0,92	0,92	0,92	0,90	0,81
GII	#	1	0,87	0,86	0,94	0,88
IDI	#	#	1	0,91	0,88	0,81
EGDI	#	#	#	1	0,91	0,82
NRI	#	#	#	#	1	0,92
GCI	#	#	#	#	#	1

Also the countries were ranked according to these six e-indexes (a fragment is shown in the Table 3).

Table 3. The list of countries ranked by e-indexes

Countries	**Rank by KEI**	**Rank by GII**	**Rank by IDI**	**Rank by EGDI**	**Rank by NRI**	**Rank by GCI**
Korea	26	18	1	1	9	22.5
Sweden	1	2	2	13	2	8
Denmark	3	6	3	15	7	10.5
Iceland	15	15	4	18	14	27
Finland	2	3	5	9	1	4
Netherlands	4.5	5	6	4	3	4
Japan	20	22	7.5	5	18	4
...	…	…	…	…	…	…
Ukraine	48	51	50	66	61	65.5
...	…	…	…	…	…	…
Ethiopia	96	95	94	91	92	86.5
Burkina Faso	90	91.5	95	95	93	95.5

The coherence analysis using the Kendall's concordance coefficient shows that the ranking of countries based on the values of six e-indexes can be considered highly consistent with a confidence level of 99% (coefficient of concordance is 0.91, the empirical value of χ^2 is 517, it exceeds the critical value $\chi^2_{crit} = 130$).

4 E-indexes 'Core' Analysis

Let's consider in detail the structure of the e-indexes and analyze partial indicators in terms of application frequency (Table 4).

The indicators, which application frequency exceeds 50%, will be named the 'core' of composite indexes (see the first eight partial indicators in the Table 4).

Another six partial indicators form the first layer of the 'shell core', their application frequency varies from 30% to 50% (see the next six partial indicators in the Table 4). The rest 12 indicators, which application frequency varies from 15% to 29%, can be classified as the second layer of the 'shell core', as many authors believe

that they are closely related to the level of ICT Adopting (eg, the difficulties in starting a new business are estimated in GCI, NRI, GII and ERI).

Besides shown in Table 4, there is a large number of indicators (let's call them 'cloud') that occurred in the calculations no more than once. For example, GII uses the number of Wikipedia articles, YouTube videos, and movies per capita; GCI considers the level of the nation's health, its impact on business.

Table 4. The 'core' and 'shell core' of the partial indicators

Partial indicators	Application frequency	Class
Number of cellular subscribers (per 100 people)	85%	'core'
Higher education enrollment	85%	
Internet users (per 100 people)	77%	
Fixed telephone lines (per 100 people)	69%	
Secondary school enrollment	69%	
Users of fixed broadband internet (per 100 people)	54%	
Users of mobile broadband Internet (per 100 people).	54%	
The index of adult literacy	54%	
International Internet traffic (Kbit/s per capita)	46%	the first layer of the 'shell core'
Primary school enrollment	46%	
Expected years of schooling	46%	
Applications for patents residents	38%	
Secure Internet servers (per 1 million people)	31%	
The proportion of households with a computer	31%	
The proportion of households with Internet access	23%	the second layer of the 'shell core'
Applications for patents of non-residents	23%	
Payments for licenses and copyright	23%	
Number of PC (per 100 people).	23%	
GDP per capita (US dollars)	15%	
Articles in scientific and technical journals	15%	
The number of households with TV (per 100 households)	15%	
International outgoing telephone traffic (min. per person).	15%	
Percentage of population with coverage telephone	15%	
The time required to start a business (days)	15%	
The number of procedures required to start a business	15%	
Severance pay for redundancy	15%	

As GII, NRI, GCI consist more than 60% of indirectly related to the ICT indicators; and NRI, GCI contain more than 60% of unverifiable data (see part 2 of the study), we choose two e-indexes (IDI and EGDI) from six which coherence was analyzed (see part 3 of the study) to check their intersection with the 'core' of e-indexes (Table 5).

Table 5 shows that the partial indicators of IDI and EGDI overlap substantially, but the IDI strongly intersects with the 'core' of e-indexes (by 73% compared to 55% for EGDI). So we would recommend using IDI to analyze ICT Adopting in details.

Table 5. The structure of IDI and EGDI

EGDI	IDI
Telecommunication Infrastructure sub-index	Access sub-index
– individuals using the Internet (% population)*	– fixed-telephone subscriptions/100 inhabitants*
– fixed-telephone subscriptions (per 100)*	– mobile-cellular telephone subscriptions/100 inhabitants*
– mobile-cellular subscriptions (per 100)*	– international Internet bandwidth (bits/s) per user
– fixed (wired)-broadband subscriptions (per 100)*	– percentage of households with a computer
– wireless broadband subscriptions (per 100)*	– percentage of households with Internet access
Online Service sub-index	Use sub-index
– emerging information services	– percentage of individuals using the Internet*
– enhanced information services	– fixed (wired)-broadband subscriptions per 100 inhabitants*
– transactional services	– wireless broadband subscriptions per 100 inhabitants*
– connected services	
Human Capital sub-index	Skills sub-index
– adult literacy*	– adult literacy rate*
– gross enrolment ratio	– gross enrollment ratio secondary level*
– expected years of schooling	– gross enrollment ratio tertiary level*
– mean years of schooling	

* Partial indicator which are belong to the 'core' of e-indexes

5 Conclusions

Comparative analysis of fourteen most popular e-indexes has allowed allocating the group of partial indicators (the 'core' of composite e-index), which application frequency was higher than 50%. The 'core' includes: indicator of literacy, enrollment in higher and secondary education, the number of mobile and fixed broadband users, and the number of cellular subscribers, internet users and fixed-line telephone.

The strong requirements to e-indexes, such as the availability of data for its assessment in the public domain, the use of reliable information for calculations; the prevailing role of the indicators that are directly related to the ICT; and the results of 'core' analysis allow us to recommended ICT Development index to monitoring of ICT Adopting.

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Session 14: Smart Regional Development

ICTs and Smart Territories. The Knowledge and Use of the UNESCO Heritage by Using the QR Codes System

Luisa Sturiale[1], Maria Rosa Trovato[2]

[1]Department of Civil Engineering and Architecture (DICAR), University of Catania, Italy, e-mail: sturiale@dica.unict.it
[2]Department of Civil Engineering and Architecture (DICAR), University of Catania, Italy, e-mail: mrtrovato@dica.unict.it

Abstract. The heritage sites included on the World Heritage List are important and highly qualified resources for the territories and communities in which they lie. UNESCO heritage should be recognised as representing the beautiful and the best of its territory, and as being a "useful" resource, in that it is capable of increasing the territories' economic, social, and cultural values. To this end, in a period characterised by deep recession and by crisis in the markets, new forms of exploitation of the heritage must be put in place. In the context of "smart management" of UNESCO heritage, new tools have been utilised, such as ICTs. In relation to this, this study proposes an extension of the use of the QR Code as a support to communication, integrated enhancement, and the coming to fruition of the territorial resources of the UNESCO site of "The Late Baroque Towns of Val di Noto".

Keywords: Smart territories, Smart heritage, QR Code, UNESCO, Knowledge-based economy, Integrated enhancement.

1 Introduction

The assets registered on the World Heritage List are, for the territories and communities which hold them, an important and highly qualified resource.

The UNESCO heritage should be recognised as being the beautiful and the best of its territory, and as being a "useful" resource to its own territory, in that it is capable of increasing the territories' economic, social, and cultural values.

To this end, in a period characterised by deep recession and by crisis in the markets, new forms of exploitation and utilisation of the heritage must be put in place.

Today, in the era of Smart Cities, the advent of Information and Communication Technologies (ICTs) offers the conditions for implementing new forms of sustainable economic development, for enhancing quality of life, for promoting human and social capital, for intelligently managing the natural resources, and for promoting engagement and processes of participatory action. An extension to the field of the Smart Cities concept, and, therefore, of the methodologies and tools of support, can

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usher in a new era, in which territorial management is of the smart type, and so it is possible talk about "Smart Territories".

Within the framework of the smart management of UNESCO heritage, new instruments have been put in place, some of them in implementation of legislative guidelines provided by the Law of 20 February 2006, no. 77 (Gazzetta Ufficiale no. 58 of 10 March 2006). Under the impulse of such national legal guidelines and in observance of the guidelines promoted by the European Union (the Europe 2020Digital Agenda for Europe initiative), it is possible to envisage new scenarios for the development and use of the territory that can be supported by the utilisation of QR Code (Quick Response Code).

This tool facilitates communication by, and utilisation of UNESCO sites and therefore improves the quality of the services offered, in a context where cultural tourism is always of a type 2.0. Today it is possible to extend the experience so far conducted in the use of QR Codes by Italian UNESCO World Heritage sites, to match what is being done on a global level with the Word Wonders Project created by Google in collaboration with UNESCO, the World Monuments Fund, and Getty Images. In this experience, the use of Google Street View technology enables the heritage sites of the world to be visited online, encouraging their exploration.

In this regard, the study proposes that the use of QR Codes be extended to communication, promotion, and integrated use of the territorial resources of the UNESCO sites. In particular, the study proposes a process of integrated enhancement for the South-East Cultural District through the design of a technological platform supported by multiple ICT instruments.

2 Methods

2.1 The Smart Territories

An extension to the concept of the *Smart City* could define a new direction of development for it, ushering in the era of the *Smart territory*.

The Smart City project was born from the conducted experience in the city of Rio de Janeiro, in which some smart technologies designed to improve community life, reduce waste in the energy sector, and improve waste management were implemented for the first time. In the Euro Area, the application of the *Smart* concept began to find support from the previsions of specific policies since 2010.

For the Spanish economist Gildo Seisdedos Domínguez[1] (Seisdedos, 2007; Seisdedos and Vaggione, 2012), the concept of the Smart City is essentially based on increasing the efficiency in the performance of cities, which can be achieved through the implementation of suitable management policies supported by two main strategic

[1] Gildo Seisdedos, (14 May 1967) is a Spanish economist and lawyer who specialises in city marketing and smart cities, and manages international forums on urban planning. He holds a Ph.D. in Urban Economics, and is a professor at the IE Business School.

axes: that based on the integration of ICT tools, and that based on the active participation of citizens (Seisdedos and Mateo, 2010; Seisdedos and Coca, et al., 2010).

The objective of policies based on the smart concept is to create added value in terms of quality of life for citizens, improve the competitiveness of enterprises (Porter and Millar, 1985), and institutions by implementing more efficient models of governance (Trovato, 2013).

The concept of smart is not only related to the use of ICT tools or high-tech projects but rather, refers to a broader sense of intelligence that involves the instruments, the subjects at all levels and from all sectors, and models of management for all the resources (O'Reilly, 2005a, 2005b, 2006).

In this regard, the knowledge-based economy supports the development of the competitiveness of the territories on the basis of the development of collective and individual intelligence, which in an increasingly globalised environment can become the levers for boosting the local economies.

2.2 The Smart Heritage

In the event that the territory has an infrastructure of resources (Sturiale, Calabrò, and Della Spina, 2010), of a historical, architectural, artistic, and environmental kind, implementing some specific smart measures may favour the creation or enhancement of some scale economies. In this regard, it is possible to introduce the concept of smart heritage as the development process that can be implemented through the use of knowledge.

The knowledge in this case creates additional knowledge (in a virtuous circle of knowledge that creates new knowledge) and added value for all the local components (Sturiale and Trovato, 2011).

In order to promote a development of this kind it is necessary to adopt a new approach to heritage, new interpretative models, and new tools such as intelligent systems and ICTs.

2.3 The ICTs and the Marketing Strategies

The advent and spread of new technologies (ICTs) has potential applications in respect to the utilisation, promotion, and enhancement of cultural and tourist resources, especially for those in urban areas (Muzzi, 2002).

The use of ICTs to support the development, promotion, and use of tourist and cultural heritage facilitates access to the information and its strengthening, enables the integration of physical experiences with virtual ones, and promotes the exchange of content and the transfer of values.

Thus, the use of ICTs in this context may widen the sphere of the user's cultural experience, implementing one of the prerequisites of the Knowledge Age.

In this, it is necessary to pass from the information dimension of ICTs to the relational dimension.

In the information dimension ICTs are essentially used to create ways of

representing the cultural heritage through three-dimensional images that allow the reconstruction of sites and environments, or the creation of real virtual museums, as a result of a process of digitalisation of the heritage.

In the relational dimension, ICTs become a way to create new knowledge, for example the Geographic Information System (GIS), Geo Tools, and web GIS, which are instruments capable of producing new knowledge of a territory.

The combined use of the Internet, GIS, and Geo Tools allows, on one hand, access to digital content and related events for the remote user and, on the other, development of content and additional services and the exchange of experiences through social networks.

The World Wonders Project, developed by Google in collaboration with UNESCO, the World Monuments Fund, and Getty Images, which uses the Street View technology also developed by Google, offers users the opportunity of visiting some of UNESCO's world heritage sites.

2.4 The QR Codes to Support the Cultural and Touristic Use of Heritage

The Association of Italian Cultural Assets and UNESCO World Heritage, with the support of the Ministry of Heritage, Culture, and Tourism (under Law no. 77/2006), has promoted the use of the QR Code for the exploitation of UNESCO heritage.

This has resulted in the implementation of the QR Code for the Italian heritage of the WHL (Association of Italian Cultural Assets and UNESCO World Heritage, 2006).

These QR Codes link to a single reference, namely the Association's websitewww.sitiunesco.it, and provide access to the section relating to the particular UNESCO site. To make effective use of the intelligent system (Mengarelli, 2013) it is necessary to place the QR Codes on road signs, posters, and printed materials such as tourist information brochures, from which they can be detected by the user with their smartphone or tablet.

In a context in which cultural tourism has undergone a radical change becoming a web type2.0, the use of QR Codes may improve the quality of the service offered (Aranguren, Niccolucci and Poggesi, 2013).

In addition, it is now possible to extend the use of QR Codes by the Association of Italian UNESCO heritage, to the level of use seen in other parts of the world with the *Word Wonders Project* (BS ISO/IEC 18004:2006, 2007), created by Google in collaboration with UNESCO, the *World Monuments Fund*, and *Getty Images*, in which the use of Google's Street View technology allows users to visit UNESCO sites online.

This application demonstrates the great potential of the QR Code for the Italian UNESCO Heritage which, if properly integrated with other ICT tools, can offer a smarter use of the heritage and the territory.

3 Application

The Association of Italian Cultural Assets and UNESCO World Heritage, with the support of the Ministry of Heritage, Culture, and Tourism (under Law no. 77/2006), has created QR Codes for the Italian heritage sites of the WHL.

Through these QR Codes, users can be directed to a dedicated space for each Italian UNESCO site on the association's website *www.sitiunesco.it*.

This is also the case for the UNESCO site which is the subject of this study, namely *The Late Baroque Towns of the Val di Noto*. This UNESCO site covers eight areas: *Catania*, *Caltagirone*, *Militello Val di Catania*, *Modica*, *Noto*, *Palazzolo Acreide*, *Ragusa Ibla*, and *Scicli*.

The QR Code should be placed on the road signs, posters, and on all printed material such as information brochures.

The QR Code can be detected through a user's smartphone or tablet, so can be sent immediately to the specific information section, that is contained in this website www.sitiunesco.it.

The action of promoting the touristic and cultural enjoyment of sites induced by the use of the QR Code is easy to implement.

In fact, once the sites have their specific reference code, it is necessary to organise the placing of road signs and posters in strategic points of the municipalities concerned, in rest stop areas, in pedestrian and vehicular routes close to bus stations, and around the railway stations and the airports and to enhance or adapt the Wi-Fi zone available in the municipalities within the area concerned.

These actions yield great potential for relatively little cost.

In theory, compared to the amount of investment required, the use of the smart system QR Code offers good advantages for increasing territorial competitiveness and adapting the touristic offer to new tourism and cultural models (Pencarelli, Betti and Forlani, 2005) of considerable interest.

To date, however, despite the fact that the QR code for the UNESCO site of The *Late Baroque Towns of the Val di Noto* has been created, the project has not been implemented completely, in that the support system of micro interventions is still missing.

This is in terms of the Wi-Fi zones which have not been strengthened or in some cases are missing (Cogo, 2010), the road signs and posters, which should be placed at strategic points of tourist flow, and the official brochures for the site, which should be distributed in local tourist offices, hotels and museums, which have not been produced.

In addition, the cognitive campaigns to support the local and industry stakeholders or the potential users have not been implemented (Rieh and Danielson, 2007).

The QR Code project has had a partial implementation. Another criticism of the QR Code project for this UNESCO site relates to the low level of connectivity of the proposed network, namely that the user is directed to the site www.sitiunesco.it, which offers a range of general information, such as the history of the site, the criteria for enrolment in the WHL, and the correlations with other historical, artistic, and archaeological sites, such as the historical centre of *Syracuse and the Rocky Necropolis of Pantalica*, the *Villa Romana del Casale* in Piazza Armerina, the *Archaeological Area of Agrigento*, the *Aeolian Islands*, and other UNESCO sites in Sicily. However, there is no link on this site to the official website of the *South-East Cultural District*, www.datanetstorage.eu/portali/siciliasudest.

The *South-East Cultural District* is a new territorial entity that incorporates all the Val di Notos stakeholders, as well as new stakeholders from other nearby UNESCO

sites in the area.

The South-East Cultural District covers the entire Noto Valley area, and other nearby areas in the south-eastern part of Sicily, and incorporates: the UNESCO site of *The Late Baroque Towns of the Val di Noto*, the *Syracuse and the Rocky Necropolis of Pantalica*, the *Villa Romana del Casale* in Piazza Armerina, and three other sites, *Acireale*, *Ispica*, and *Mazzarino*, which are in the candidacy phase for inclusion on the UNESCO list.

In total, the *South-East Cultural District* comprises 16 municipalities (*Acireale, Caltagirone, Cassaro, Catania, Ferla Ispica - Mazzarino, Militello Val di Catania, Modica, Noto, Palazzolo Acreide, Piazza Armerina, Ragusa, Scicli, Siracusa, and Sortino*), and has its head quarters in Syracuse, at the Superintendent BB.CC.AA. Piazza Duomo, 14.

The website of the *South-East Cultural District* relates the heritage of more UNESCO sites and all the historical, cultural, archaeological, artistic, environmental resources, and food and wine products of this territory, offering multimedia services, and virtual tours in support of the tourism (D-web, 2010).

Thus, as part of the tourism and cultural promotion of the UNESCO site of *The Late Baroque Towns of the Val di Noto*, it would be appropriate to make use of the information infrastructure and services offered by the website of the "South-East Cultural District" (Sturiale and Trovato, in publication phase), which is the only official website among the many that use the *UNESCO brand* or the *Val di Noto brand*, but which are not official or reliable.

4 Results

4.1 ICTs and the Integrated Promotion of the South-East Cultural District

The *South-East Cultural District* is a vast area that is characterised by the presence of three UNESCO sites. The District's heritage is of the historical, cultural, artistic, archaeological, architectural, and urban type.

In this regard, the three UNESCO sites have obtained enrolment in the WHL on the basis of several criteria types.

But the District's area is also qualified by the high level of the environmental, agro-food, and social resources, and its political institutions.

The enhancement of these sites is to be implemented through a marketing project in which the use of ICTs has be considered as a powerful tool for adapting the cultural and tourism offer to the new models of demand. In particular, it is possible to integrate the QR Code project proposed for the UNESCO sites and implemented by the Association of Italian UNESCO Heritage, with the support of the Ministry of the Heritage, Culture, and Tourism (Law no. 77/2006), into this marketing project. Connection to the website of the South-East Cultural District does not currently form part of the Association's proposed project, but considering what has been noted in the previous paragraph, this action would appear to be a prerequisite to qualify the cultural and tourism offer in this area.

The new technological platform to support the integrated promotion of the *South-East Cultural District* can be implemented by using a structure based on the QR Codes of the Italian UNESCO sites, which have already been created, on the strengthening of the Wi-Fi zones of the municipalities, many of which are already present, and on the introduction of a micro QR code project which has yet to be realised, in order to have access to some specific information related to the events, museums, the restoration (Scarpitti and Milaneschi, 2013) of monuments, such as the restoration of Noto's Cathedral of St. Nicholas, after the damage it sustained in the earthquake of 13th December 1990, and the structural collapse on 13th March 1996 that, due to a serious construction defect of the principal nave's pillars, led to the collapse of the entire right aisle of the central nave and the south transept, which left only a small part of the drum standing; and the restoration of the *Villa Romana del Casale* in Piazza Armerina, as well as information about the local wine and food products, and about all the qualified cultural resources of this area.

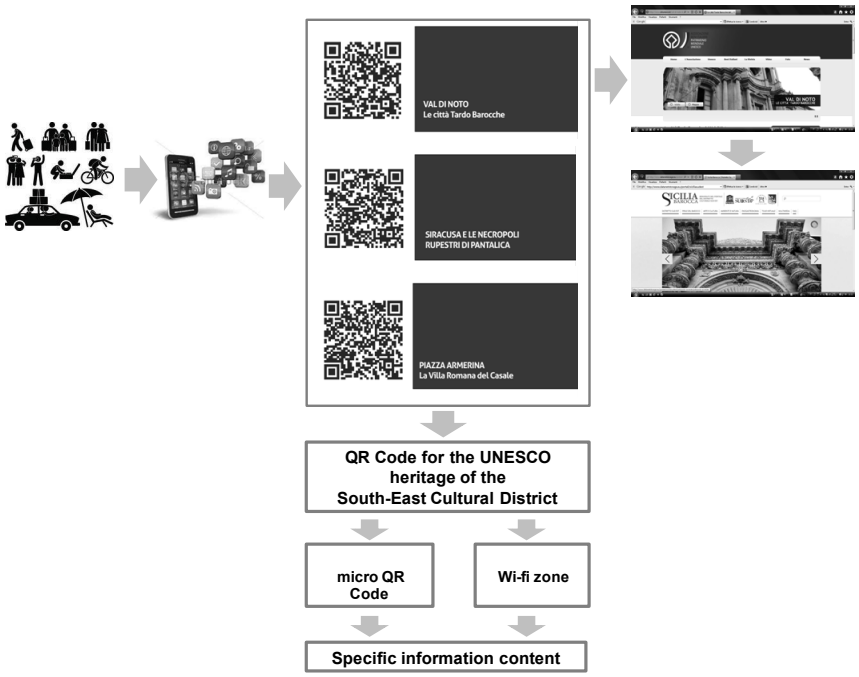

Fig. 1. The technological platform to support the integrated promotion of the South-East Cultural District

5 Conclusion and Discussion

The actions aimed at increasing the attractiveness and competitiveness of places of culture in the context of a 2.0 tourism type should focus on the level of quality of services offered to the web-globetrotters by the websites.

The improvement of additional services requires a relatively low level of financial investment, and is more related to the short or medium term dimension (Laurent, 2008).

Therefore, this type of improvement is easier to implement than that required to increase the level of perceived cultural value of a site, or of its identity, or even of increasing the quality of the available accommodation, all of which generally require long-term planning.

In the era of the *Knowledge Age*, ICTs enhancing local competitiveness in a globalised context means turning our territories into Smart territories, thus promoting the development of a territory of an integrated, intelligent, participatory, technological, open, and interactive type, and where the prevailing criteria are those of efficiency, clarity, democracy, and knowledge as a tool for enhancing the different forms of territorial capital.

The new technologies (ICTs) can find applications in the sector of the use, promotion, and enhancement of cultural and tourism resources.

Their application is changing the relationship that classically links the subject who has control of the asset, with those who promote it and enhance it, and those who benefit from it.

This is opening the door on an era in which the managing entity can directly control the actions of promotion and enhancement, and consequently influence and directly guide the use of the heritage.

In addition, the use of ICTs promotes the strengthening of information through the integrated use of physical and virtual experiences; and expands the contents and the transfer of values, evolving from an informative to a relational dimension.

From this it is clear that the approach of a knowledge and experience based economy, and the new ICTs, can provide the tools necessary to create a new layout of coordinated development between the heritage and the user, that is capable of generating a new valuation of the heritage that makes use of a new type of *smart heritage*.

Even the European regulations are moving in this direction (with the Europe 2020 Digital Agenda for Europe initiative),which promotes, among other aspects, the use of the QR Code for the use of UNESCO heritage.

An extension of the use of the QR Code for the activities of communication, promotion, and integrated use of the territorial resources of UNESCO sites, i.e., as tools for linking territorial resources, can help to define a direction of development for the territory that offer great potential for relatively little cost, with this factor being of considerable importance in a period characterised by severe economic crisis.

The ability to interconnect territorial resources through ICTs provides the means to increase local competitiveness in an increasingly globalised context (Sturiale, 2013), transforming the territory into a Smart territory and the heritage into smart heritage, and defining the direction of development and enhancement of the *useless*

hidden and sublimated that is just waiting to become *useful* and *revealed*. In this regard, the study proposes the adoption of a new approach to territory and cultural heritage of a smart type.

In particular, this study promotes an enhancement project for the South-East Cultural District through the implementation of a new technology platform that is based on the integrated and hierarchical use of the QR codes which have been generated for the District's UNESCO sites.

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Investigation and Evaluation of the Applicable European Environmental Policy in Rural Area from the Urban Population (Greece)

Evgenia Kokkinou[1], Georgios Vlontzos[2]

[1] School of Agricultural Sciences, Department of Agriculture Crop Production and Rural Environment of Volos, Greece, email: ekokinou@otenet.gr
[2] School of Agricultural Sciences, Department of Agriculture Crop Production and Rural Environment of Volos, Greece, email: gvlontzos@agr.uth.gr

Abstract. The environment is beyond any form of political, legal and human power. The protection and quality has always been one of the most important components for the improvement and development of life. In 70s began to show the first signs of environmental degradation because of pollution, the allogistis use of natural resources, the resulting energy crisis and the forthcoming population growth on the planet, the European Union has played and continues to play a key role in protecting and safeguarding the environment. This was achieved by a series of legislative environmental regulations (International and European level) and by funding programs and environmental protection instruments. The purpose of this paper is to explore how the perception of the urban population in Greece is implemented the Environmental Policy through the Common Agricultural Policy (CAP) in the primary sector. For this reason, conducted field research by completing questionnaires. The main insights is that urban residents have incomplete knowledge, education and information on environmental issues, which leads to favor the intensive form of cultivation and exploitation of the agricultural land in order to increase production efficiency in any cost.

Keywords: Sustainability / Sustainable Development, Urban population, rural resident, nature conservation.

1 Introduction

1.1 Environment

The protection and quality of the environment has always been one of the most important components for the improvement and development of life.

The term environment is used to denote the organic and inorganic nature that surrounds us. Also, the family or the society in which a person lives and has an impact on the mental and intellectual formation. It is distinguished by a natural or artificial primary and secondary (or geographic) (Urn Sun Cambridge, 1992).

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Already in the early 70s, began to appear the first signs of environmental degradation mainly due to pollution (soil, water, air), reduction of natural resources and the subsequent energy crisis. The situation then combined with continued human activity on the environment and the upcoming population growth led to the need for legislative environmental regulations both in international and in the community, the most significant of which are presented in the following Table 1 (Athanasopoulou et al.,2009; Patronos, 2000; Orfanou, 2011; Lazaridou, 2007; Pezaros, 2010; Koufopoulou, 2007; Korkovelos, 1997; Tsiforos et. al., 2014; Greek Republic - Ministry of Rural Development and Food, 2011; europa.eu.gr; climate.wwf.gr; www.econews.gr; www.minagric.gr):

Table 1. Legislation governing the protection of the environment.

International Law	➢ The Stockholm Declaration 1972 ➢ The Declaration of Rio de Janeiro in 1992 ➢ Kyoto Protocol in 1997 ➢ Johannesburg World Summit in 2002 ➢ Malmo Ministerial Declaration 2009
European Law	➢ The Single European Act (SEA) ➢ The Maastricht Treaty in 1992 ➢ The Treaty of Amsterdam in 1997
Greek Legislation	➢ Constitution of 1975/1986/2001 - introduction of the environment as a legal good through constitutional provisions (Article 24, paragraph 1) ➢ Adoption of Law 360/76 "On Planning & Environment» ➢ Adoption of the Law 2742/99 "on Spatial Planning and Sustainable Development"
Common Agricultural Policy (Cap)	➢ Single Market ➢ Community Preference ➢ Financial Market ➢ Pillar I regard the direct payments of the CAP ➢ Pillar II rural development

1.2 Purpose

Inhabitant research aims to record and evaluate the view, knowledge and awareness of urban dwellers of Larissa and Volos, in relation to the European environmental protection policy applied especially in rural areas. In addition, there is the ambition of this research to be able to contribute to the evaluation and pontification of environmental awareness regarding to common agricultural policy environmental reconditions for farming.

2 Urban and Rural Environment

The urban environment is identified both population and spatially with the city and its functions. It is densely populated urban areas served numerous human activities, is a major market for the promotion of agricultural products, opportunities for major employment opportunities and work in a variety of commercial properties and the end is standard life, work, consumption and socio - economic organization (Satterthwaite, 2003; Kokkosis, 1994).

On the other hand, rural environment supports the survival of human populations. Earth, water and forests are the primary resources of agricultural production which are necessary for the preservation of human life and prosperity. The use of these resources should be maintained at a constant balance to be able to support the sustainable development of the world, but also to avoid or at least reduce environmental degradation and losses in agricultural productivity. Moreover, the rural environment offers production areas of agricultural products and establishment of small rural crafts, business premises secondary and tertiary sectors such as industrial areas, stores and relaxation space, recreational, ecological and environmental balance breeding and conservation (Moysidis & Ntyken, 1999; OECD, 1994).

The science of agriculture is the basis upon which civilization was built. By agriculture refer to the cultivation of land for the production of useful products and the breeding of domestic animals for the production of mainly meat and leather, yarn or as pack animals in the farm work is eminently biological nature. Handles living plant and animal organisms, who attribute if and by ensuring in every case the right environment. "Georgia is a factory without a roof" as features had said Professor Gold Evelpidis (Papageorgiou, 2010).

Agriculture has an interdependent relationship with the environment, which in turn directly affects both the quantity and quality of production. This strong dependence of agriculture on the environment creates an uncertainty in production (qualitative and quantitative) and the quantities offered products on the market, due to the influence of unforeseen factors. This uncertainty also has the ability to influence prices upwards or downwards. Moreover, the environmental factor limiting the production capacity of each region by excluding certain types of production. This depends on some environmental parameters such as soil texture, style water table, irrigation potential, atmospheric moisture, frost, winds, temperature, etc. that help better develop production. Finally, affects the pocket of the producer when he makes effective adaptation of the environment to the betterment of the necessary conditions for plant and animal organisms (such as greenhouses, frost protection, modern farms) (Papageorgiou, 2010).

Over the years, have adopted and adapted several types of agriculture to meet the needs of people each season, the main of which are listed below (www.syngenta.com; www.Wikipedia.gr; Evaggelou et al; Maurogiannopoulos, 2005):

- ✓ Traditional Agriculture
- ✓ Intensive agriculture
- ✓ Sustainable Intensive Farming
- ✓ Intensive Controlled Agriculture – Greenhouses

- ✓ Precision Agriculture
- ✓ Biological and Ecological Agriculture

Important role in the growth and development of agriculture have played and continue to play the farmers, who fall into two categories (high & low importance) according to their beliefs, their traditions, their environmentally friendly behaviors, economic benefits and prestige offers the work of the farmer and the enjoyment and independence of work. Below in Table 2 are outlined the eight types of farmers, who are divided into two categories, high and low importance (Schmitzberger, 2005).

Table 2. Farmers Categories

Division 1. High Importance	➢ Traditionalist ➢ Yield Optimiser ➢ Innovative ➢ The Support Optimizer
Division 2. Low Importance	➢ The part - time farmer ➢ The forced Farmer ➢ The Idealist ➢ The social farmer

3 Evaluation of Environmental Policy

The environmental policy includes two main conditions: the environment and politics. It deals with the responsibilities and obligations towards environmental issues such as air pollution, water, soil, protection and management of the rural environment, conservation of biodiversity, protection of natural resources and endangered species and toward people who monitor and implement national and European legislation and while conducting ongoing research to implement new practices more environmentally friendly (Urn Sun Cambridge, 1992).

The evaluation of environmental policy is an administrative process for the collection, processing and dissemination of information on environmental and other impacts of projects and policies. Assists, the difficult task of making decisions and the selection of alternatives for the construction and operation of infrastructure. For this reason, it is governed by three basic principles*: the Precautionary Principle, the Precautionary Principle and the Principle of "Polluter Pays"* (www.europa.eu.gr; Siouti, 2003; Papandreou et al., 1999).

Additionally, have created and implemented six standards of environmental evaluation systems for better management of environmental protection: the ISO 14000, the International Standard ISO 14001, the EMAS Management System standard BS 7750, the CERES system and the system of Responsible Care (Machairas, 2003; Woodside et al., 1998; Giama, 2001; Jackson, 1997).

4 Materials & Methodology

The survey was conducted in May and June 2014 in the cities of Larissa and Volos and was field research. The cities of Larissa and Volos were selected to conduct this survey as representative areas of Greece due to the clear contrast between urban and rural areas. Also, the population of both cities is the same. Data collection was done by using written questionnaires and individual completion time supplementing them did not exceed 10 to 15 minutes. Respondents knew from the beginning purpose of the research and they were quite receptive to completing the questionnaires.

The questionnaires were anonymous, which made the investigation easier and the form contained in the first (1st) place six questions (6) demographics (such as age, sex, income, education level) and second (2nd) of nine questions (9) closed type where invited to express their views on the rural environment and more specifically on the protection measures, obligations and responsibilities of farmers, its biodiversity, the impact of chemicals used (fertilizers, herbicides , pesticides), production etc .. Each question should be rated based on higher Likert scale from -4 to 4, and (including numbers and other intermediates of the scale), where the characteristics stated -4: disagree ; 0: neither agree nor disagree and 4: I agree completely. The total sample size was 100 people - questionnaires (50 in the region of Larissa and 50 in the region of Volos) (Galanis, 2012).

After collecting the questionnaires we had our categorization and analysis of data. Typically, in our survey participated hundred (100) people, of which 47% were male and 53% were women. Then, for better analysis of statistical results distinguish the categories for age and education - educational level of respondents.

5 Data Analysis Methods

By using the SPSS software program we made in the analysis of our data. We used the method of factor analysis (factor analysis - FA). The main role of exploratory analysis Factors (exploratory factor analysis - EFA) is yet to investigate a possible underlying formation of interrelated variables without imposing any specific structure of the results. This method allows us to determine the factorial structure or model for a series of variables (Bandalos, 1996). The extraction method was the principal component analysis (principal component analysis - PCA) based on rotation varimax. We decided to use the principal component analysis method (principal component analysis - PCA) because our aim was mainly to see what knows the urban world to the environment in general and especially for the rural environment, whether it agrees with the protective measures to be taken, how to behave environment but if somehow involved in protection (Conway et al., 2003; Yaremko et al., 1986).

Additionally, to evaluate the adequacy and quality of exploratory analysis Factors (exploratory factor analysis - EFA) as a solution, we consider successively two criteria:

A) The data refer to the amount of the variance, which represents each variable.
B) The item Kayser - Meyer - Olkin (KMO)

For the initial variables, Common Factor Variations (communalities) is the percentage of each variation calculated for all the factors that have been exported. Based the Kaiser HF (1974), we have to admit that the element KMO> 0.70 is an important threshold of sampling adequacy.

Finally, the model chosen and regular regression (ordinal regression model) to estimate the relationship between environmental consciousness and awareness and various factors that may affect it. The general form of the function is link (yij) = ln (-ln (1-y)), while the form of the model is the following (Norusis, 2004; Minetos & Polyzos, 2010):

$$\ln(\theta_j) = \alpha_j - \beta_n X_n$$

where:
j: the number of categories minus 1
α: constant parameter regression
β: the coefficients of the regression
X: the independent variables

6 Results

The aim of factor analysis is to achieve more easily interpretative solution and explain the correlations between observed variables. We parted our sample into three categories (FACT1, FACT2, FACT3) scale environmental awareness based on the data we collect (questionnaires). We can see that the first (1st) group FACT1 (table 3 - Rotated Component Matrix), including questions 2, 3 and 6 of the questionnaire (table 4), loads of variables is positive which means that a positive correlation between them. These three variables relate to people who believe in an agriculture that should not have any environmentally friendly dimension and protection, and its role is clearly productive. In the second (2nd) group FACT2, including questions 4, 5, 7 and 8 of the questionnaire, presented high and positive components together. This means that this special group of people is in favor of intensive forms of cultivation and exploitation of agricultural land, where the protection measures and environmentally management are unnecessary and "luxury". Finally, the third (3rd) group FACT3, including questions 1 and 9 of the questionnaire also shows high loadings on variables related to the positive financial results of production, which should be of concern to farmers farm farmland.

Finally, based on the significance observe that the education level of people involved in completing the questionnaires was instrumental in the results since it is statistically significant (<0.05) between them for the four categories of education (Edu1, Edu2, Edu3, Edu4) selected. Instead, we see that the ages of the individuals did not affect significantly the results with significance greater than 0.05 (for Age1 {0.1} and Age2 {0.1}). Finally, the three factors FACT1, FACT, 2 and FACT3 statistically significant (<0.05) and come to the same conclusion regarding the missing information and knowledge of citizens who reside in urban centers on the protection and management of both environmental and especially the rural environment.

Table 3. Rotated Component Matrix

Rotated Component Matrix				
		Component		
		1	2	3
FACT1	VAR02	0.738515089		
	VAR03	0.71595599		
	VAR06	0.681913574		
FACT2	VAR04		0.710609655	
	VAR05		0.647369956	
	VAR07		0.559093712	
	VAR08		0.5129839	
FACT3	VAR01			0.803427913
	VAR09		0.456970509	0.6095057
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.				
a		Rotation converged in 7 iterations.		

Table 4. Questionnaire

QUESTIONS		
1.	VAR01	The design production and financial management is the most essential elements for a successful farm.
2.	VAR02	There is no reason to protect rare species which may visit farms.
3.	VAR03	Farmers have the right to manage their farm as they believe is better.
4.	VAR04	Farmers have responsibility to produce sufficient food, rather than to protect the environment.
5.	VAR05	Today the quality characteristics of agricultural land are better than a few years ago.
6.	VAR06	If it is possible, laborers must be replaced by machinery and new technologies.
7.	VAR07	The protection of the rural environment is primarily addressed to hobbyist's farmers or farmers who live in poor and barren areas.
8.	VAR08	The achieving of high producer is the proof of good producer.
9.	VAR09	Financial sustainability should be the indicator for what happens on a farm.

7 Discussion

In this work was given an overview of the environment and the role it plays in people's lives and they in turn can disrupt the balance. The effects of the environmental problems affecting their quality of life and create social inequalities. These problems are more values crisis and adjustment problems of human behavior and less technologically. The change of values can give the motivation for action and meaningful change in society based on the principles of social justice for prosperity. Consequently, it is necessary lifestyle changes and remodeling behavior, emphasizing the creation of an evaluation code to ensure the interest of all life forms and creates environmental ethos.

The complexity of the environment can and are sure to cause conflicts to be a creative management of conditions which will ensure both the integrity of ecosystems and the welfare of people. The New Common Agricultural Policy will be more ecologically aware and more sensitive to environmental issues (Bureau et.al., 2008; Haskins, 2010).

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Consumers' Attitudes Towards the Development of Transgenic Forest Trees and their Products in Greece

Lambros Tsourgiannis[1], Vassiliki Kazana[2], Valasia Iakovoglou[3]

[1]Region of Eastern Macedonia & Thrace, 67100 Xanthi, Greece,
e-mail: ltsourgiannis@gmail.com
[2]Department of Forestry & Natural Environment Management, Eastern Macedonia & Thrace Institute of Technology, 66100 Drama, Greece, e-mail: vkazana@gmail.com
[3]Department of Forestry & Natural Environment Management, Eastern Macedonia & Thrace Institute of Technology, 66100 Drama, Greece, e-mail: viakovoglou@yahoo.gr

Abstract. This paper aims to examine the attitudes of the consumers in Greece towards the use of biotechnology in forest plantations and their potential purchases of forest transgenic products. Three groups of factors related the consumers' attitude on the use of biotechnology in forest plantations with the potential purchases of transgenic forest products: (a) the potential negative environmental impacts (b) the potential positive impacts on production processes, and (c) economic impacts. Furthermore, this study indicated that consumers who intent to buy paper products derived from Genetically Modified (GM) forest trees, were concerned for the environmental impacts of the GM trees and then on the production process that was followed by economic issues. No significant relationships were found between the consumers who declared that they intent to buy wood and woody biomass energy products derived from GM trees and the importance of the factors that affect their attitudes towards the adoption of biotechnology in forest plantations.

Keywords: Consumer behaviour, Genetically Modified Trees.

1 Introduction

It has been argued that the use of biotechnology in commercial forest plantations would contribute to increased forest productivity, improved pulp for paper and biofuel production, climate change mitigation, preservation of biodiversity and reduction of energy, pesticides and fertilizers utilization (Sedjo 2006, Chapotin and Wolt 2007, FAO 2008, 2010, Hinchee et al. 2009, Flachowsky et al. 2009, Harfouche et al. 2011).

Specifically, the use of GM trees in forest plantations may provide several economic advantages. Aside from increasing the trees' viability and reducing losses to folivores, fungi and bacteria, these types of modifications could also decrease the need for pesticides and consequently affect the costs associated with tree production (Mathews and Campbell 2000). The use of herbicide –resistance trees would also

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allow producers to apply broad –spectrum herbicides to control weeds and therefore reduce the need for traditional and costly methods of weed control (Mathews and Campbell 2000). Furthermore, increased resistance of GM trees to abiotic stress could mean a more efficient growth and therefore, improved productivity (Johnson and Kirby 2001). Also, another economic advantage regarding the establishment of GM forest trees is the reduced amount of time required to develop improved phenotypes (Mathews and Campbell 2000; Pena and Seguin 2001).

On the other hand, the use of biotechnology in forest plantations could lead to a decrease in the perceived social and economic value of natural forests, as the economic gains from these types of forests would not be as large as those received from GM forest plantations (Haynes 2001). A further economic concern relates to the fact that low income wood producers might not be able to have access to GM trees given their relatively high cost (Thomas 2001). Also, Thomas (2001) argued that GM trees might generate profit for certain producers in the private sector while low income producers would become further marginalized. Furthermore, the application of GM technologies to forest trees has raised a number of potential public concerns. Many of these concerns, are similar to those of the GM annual crop plants and are mainly associated with the potential spread of antibiotic or herbicide resistance genes to the native tree genetic pools; the potential for long – distance pollen spread, the potential for adverse effects on biodiversity from GM tree plantations; and any unexpected effects (Gartland et al 2003, El- Lakany 2004,Van Frankenhuyzen and Beardmore 2004, Williams 2006, Sedjo 2006, Farnum et al. 2007, FAO 2008, 2010).

As no food safety issues are involved (although cellulose is sometimes used a filler in foods) the extent to which retail consumers might resist transgenic wood products appeared to depend largely on their environmental and philosophical concerns (Serdjo 2004). Therefore, it is important to know therefore how the attitude of the consumers of potential forest transgenic products in Greece would affect their buying decision. In this context, the aim of this study was to explore the attitudes of the consumers towards the use of biotechnology in forest plantations in an E.U. country, Greece and to profile them according to their willingness to buy products that could derived from GM trees. Further, this work was coordinated within the frame of the European COST ACTION FP0905 that focused on various biosafety aspects, such as analyses of the efficiency of existing gene containment strategies to avoid or to minimize gene flow or evaluation of methods to monitor GMTs in the whole production chain (Fladung et al. 2012, Vettori et al. 2014).

2 Methods

A survey was implemented to identify the factors that affect the consumers' attitudes towards the use of biotechnology in forest plantations. Furthermore, it explored the association between the consumers' attitudes towards the use of biotechnology in forest plantations and their intention to buy products.

Therefore this study examines the rejection of the following research null hypotheses:

- **Ho1:** There are some main factors that do not affect consumers' attitudes towards the use of biotechnology in forest plantations.
- **Ho2:** The factors affecting consumers' attitudes towards the use of biotechnology in forest plantations are not significantly associated with their intention to buy products derived from GM forest trees.
- **Ho3:** The factors affecting consumers' attitudes towards the use of biotechnology in forest plantations are not significantly associated with consumers' classification regarding their buying behaviour towards transgenic tree derived products.

2.1 Survey Procedure

The information for the survey was gathered through field interviews following a systematic stratified sampling method (Moser 1958; Errington 1985; Barnett 1991; Oppenheim 2000). According to Errington (1985) the units for survey were randomly selected from the larger population in order to generalize the conclusions. So, every sixth customer that was entering into the survey area was undergoing the interview (McCluskey *et. al*., 2003).

The size of the selected sample was based on Siardos' methodology (Siardos 1997). Particularly, the representativeness of the sample was immunized by checking the sample proportion of the consumers who declared that they would buy forest products of transgenic origin with the consumers in the pilot survey who declared that they would buy these products. More specifically, the proportion of consumers (p) in the pilot survey who would buy at least once a product of transgenic origin, such as woody biomass energy product or woody product was 86%. Therefore, in order to achieve a representative sample, the sample size should have been at least 420 consumers (in order to have z=3 and d=5%). Furthermore, the power analysis that was conducted by using the Gpower software (Faul et.al. 2009) indicated a total sample size of at least 132 consumers for a medium effect size (Cohen 1988) of a power of 0.95. Hence, the sample size of 450 consumers was considered "representative" since it was more than three times the indicated size by the power analysis and the 86% of consumers, who declared that they would buy a transgenic-tree derived product. The productive sample consists of 418 consumers.

2.2 Questionnaire Design

Based on the literature, the factors that affected the development questions involved in the questionnaire were the consumers' behaviour towards GM forest trees derived products and the consumers' attitudes towards the development of transgenic plantations. Furthermore, the questionnaire was designed in order to meet the research's objectives and it was pre-tested in academics, marketing experts and consumers. In order to verify any modifications at the structure of the questionnaire, a pilot survey of 30 consumers was conducted in October of 2011. The results from

this pilot survey indicated that there was need for further modification and therefore, the main survey was conducted between November and December of 2011.

2.3 Statistical Methodology

Multivariate analysis techniques were performed for a total of 418 consumers to reveal the key information contained in the responses. Particularly, Principal Component Analysis (PCA) was used to identify the variables that accounted for the maximum amount of variance within the data in terms of the smallest number of uncorrelated variables (components). The anti-image correlation matrix was used as well as Bartlett's test of sphericity and the measure of sampling adequacy (MSA) in order to check the appropriateness of the data for subsequent factor analysis. The variables that had a high proportion of large absolute values of anti –image correlations as well as MSA less than 0.5 were removed before analysis.

PCA reduced the 8 key attitude variables, which relate to consumers' opinion about the use of biotechnology in forest plantations to a smaller set of underlying factors. An orthogonal rotation (varimax method) was conducted and the standard criteria of eigenvalue = 1, scree test and percentage of variance were used in order to determine the factors in the first rotation (Hair *et al*. 1998). Different trial rotations followed where factor interpretability was compared.

Statistical tests based on the outcomes of the factor analysis presented above were used to test three hypotheses presented in previous section.

3 Results

Principal Components and Factor Analyses (through a varimax rotation) were conducted to identify the key consumers' attitudes towards the use of biotechnology in forest plantations, and the latent root criterion (eigenvalue =1), the scree plot test and the percentage of variance were used to determine the number of factors.

PCA identified three factors that affect consumers' attitudes towards the use of biotechnology in forest plantations (Table 1).

Table 1. Main Factors Affecting Consumers' Attitudes towards the use of Biotechnology in Forest Plantations.

KEY ATTITUDE DIMENSIONS	Factor Loading
Negative Environmental Impacts	
Negative impact on biodiversity conservation	0.829
Negative impact on the environment	0.789
Possibility to harm human health	0.746
Positive Impacts on production process	
Reduction of production losses	0.747
Important for biomass production	0.725
Economic Impacts	
Reduction of production costs	0.861
Increase of return	0.782

KMO MSA = 0.743
Bartlett test of Sphericity = 977.656, P <0.001

In particular consumers' attitudes towards the use of biotechnology in forest plantations were mainly influenced by:

(a) the potential negative environmental impacts of the adoption of such technology that retain negative impacts on biodiversity conservation, the environment and possibility to harm human health,
(b) Potential positive impacts on production processes, such as the reduction of production losses whilst they consider the use of GM technology in forest trees as an important factor for biomass production, and
(c) economic impacts, such as reduction of production costs and increase of the returns from the forest plantations.

Therefore, the hypothesis ***Ho1:*** *"There are some main factors that do not affect consumers' attitudes towards the use of biotechnology in forest trees"* may be rejected.

Moreover, the non-paramateric Friedman Test was performed to explore the association between the factors that affect the consumers' attitudes towards the use of biotechnology in forest plantations in Greece and their intention to buy each category of GM forest products; specifically, (a) paper-, (b) wood-and (c) woody biomass energy products. Hence, this study indicated that consumers who intent to buy paper products derived from GM forest trees, were mainly concerned for the environmental impacts of the GMTs and then on the production process that was followed by economic impacts (Table 2). No significant relationships were found between the consumers who declared that they intent to buy wood and woody biomass energy products derived from GM trees and the importance of the factors that affect their attitudes towards the adoption of biotechnology in forest plantations.

Table 2. Importance of the factors affecting consumers' attitudes towards the use of biotechnology in forest plantations

Factors affecting consumers' attitudes towards the use of biotechnology in forest plantations	**Consumers who intent to buy paper products that could be derived from GM forest trees (x2=6,829, df=2, P<0,05)**	**Consumers who intent to buy wood products that could be derived from GM forest trees (x2=2,31, df=2, N.S)**	**Consumers who intent to buy woody biomass energy products that could be derived from GM forest trees (x2=0,109, df=2, N.S)**
Environmental Impacts	2,1	2	2,02
Impacts on production process	2,05	2,04	1,99
Economic Impacts	1,85	1,96	1,99

Therefore, the research hypothesis **H2:** *"The factors affect consumers' attitudes towards the use of biotechnology in forest plantations are not significantly associated with their intention to buy GM forest products"* may be rejected.

Tsourgiannis *et. al.* (2015) identified four groups of consumers according to their potential buying behaviour towards forest products derived from transgenic-trees : (a) consumers who were interested in the product's quality, (b) consumers who were orientated towards lower prices, (c) consumers who were influenced by labelling and curiosity issues and (d) consumers who were interested in health safety issues and the environmental impacts. In this study the Friedman one way non parametric test was employed in order to explore which factors affected consumers' attitudes towards the use of biotechnology in forest plantations in Greece that have an impact on each group of consumers (Table 3).

Table 3. Importance of the factors affecting consumers' attitudes towards the use of biotechnology in forest plantations for each group of consumer

Key attitude dimensions	**Group of Consumers**			
	Consumers who are interested in the product's quality (x^2=1.440, df=2, N.S)	**Consumers who are orientated towards lower prices (x^2=2.391, df=2, N.S)**	**Consumers who are influenced by labelling and curiosity issues (x^2=9.260, df=2, P <0.05)**	**Consumers who are interested in health safety issues and the environmental impacts (x^2=2.319, df=2, N.S)**
Negative Environmental Impacts	2.12	2.00	2.21	2.21
Positive Impacts on production process	2.00	2.04	1.89	1.89
Economic Impacts	1.88	1.96	1.90	1.90

The test indicated that most of the consumers who were influenced by the labelling and curiosity issues paid attention mainly on the environmental impact that the adoption of biotechnology might have in the forest tree sector and then on

economic issues and lastly on the positive impact on production processes. No significant association was found between the other three groups of consumers and the importance of the factors that affect their attitudes towards the adoption of biotechnology in forest plantations.

Hence, the hypothesis **Ho3:** *"The factors affect consumers' attitudes towards the use of biotechnology in forest plantations are not significantly associated with consumers' classification regarding their buying behaviour towards transgenic tree derived products"*, may be rejected.

4 Discussion - Conclusions

This study investigated the main factors that affect the attitude of potential consumers towards the utilization of transgenic trees and their products and influence their willingness to buy those products. It showed that consumers' attitudes towards the use of biotechnology in forest plantations were mainly affected by the impact of that technology might have on the environment, biodiversity, and human health, as well as by its positive impact on production processes and economic impact.

This study supports the findings of other studies according to which consumers were mainly affected in their preferences towards transgenic trees and their potential products, from their environmental and philosophical concerns. Consumers appeared positively orientated towards the use of biotechnology in forest plantations, probably because the products derived from forest trees are not food and therefore they were considered less dangerous to human health.

A limitation however of this survey needs to be mentioned. The adopted statistical methodology although it explored the factors that affect consumers' buying behaviour, which is useful for marketing analysis and strategy development can not measure the demand of a product or determine the importance of the characteristics of a product that affect consumers' behaviour. These measurements can be made with the use of other statistical techniques such as conjoint analysis and contingent valuation.

Nevertheless, the current study is of value, since according to our knowledge, this is the first attempt to explore the consumers' attitudes towards the development of transgenic trees and their products, as well the factors that affected their attitudes towards the adoption of such technology in forest plantations. According to the results of the study the potential developers of such forest tree plantations and paper, wood and woody biomass energy products should structure their marketing and promotion mix and focus on environment protection, and economic efficient production methods. Furthermore, campaigns that will aim to inform public about the use of biotechnology in forest plantations and its advantages and disadvantages should take place.

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Evaluation of Regional Web Portals

Vladimír Očenášek[1], Miloš Ulman[2], Jiří Vaněk[2], Edita Šilerová[2]

[1]Faculty of Economics and Management, Czech University of Life Sciences in Prague, Czech Republic, e-mail: ocenasek@pef.czu.cz
[2]Faculty of Economics and Management, Czech University of Life Sciences in Prague, Czech Republic

Abstract. Evaluation of regional web portals is based on methods of Digital Governance in Municipalities Worldwide. We evaluated 6 regional web portals using 12 parameters in area of content and services. From the five possible evaluated areas belonging to methodology of Digital Governance in Municipalities Worldwide, we focused on the areas of content and services. We compared Czech web portals against Austrian and Swiss web portals. The highest number of points got Posázaví (welcome in the tourist region around the river Sázava (www.posazavi.com)), which obtained full score for immediate updates, searchable databases, newsletter subscription, event calendar and capabilities of GIS. Evaluation brings insight in matter of increasing attractiveness and website traffic of concerned portals, which would lead to increase in visitors of concerned regions.

Keywords: Digital Governance in Municipalities Worldwide, Rutgers – SKKU – E-Governance Performance Index, regional web portal, regional touristic headquarter, multilingual support, event calendar, searchable database, accommodation and event reservation

1 Introduction

There are many of different rankings in the world, which relate to information and communications technology. For example, United Nations e-Government survey evaluates expansion of e-government administration in 193 countries in the world every two years and publishes worldwide ranking of EGDI (e-government development index).

Since 2003 web portals of capitals of the largest countries in the world have been evaluated by - Digital Governance in Municipalities Worldwide (Holzer et al., 2014) every two years. This rating is organized by the "The E-Governance Institute" which is part of Rutgers University Newark. Prague (15 in) was included for the first time in 2007. Prague was ranked in excellent 2nd place in 2009, in the period 2011 - 2012 was in 4th place and in the period 2013 - 2014, Prague ranked 10th. (Pazderník, 2013). Our methods of evaluation are based on methods of Digital Governance in Municipalities Worldwide, which is focused on regional web portals.

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2 Methods

Rutgers-SKKU E-Governance Performance Index is calculated during methods of Digital Governance in Municipalities Worldwide. Regional web portals are evaluated based on predefined criteria of this index. The survey evaluates websites of municipalities in terms of privacy, usability, content, services, and citizen and social engagement, and ranks them on a global scale. The Rutgers-SKKU E-Governance Performance Index is calculated within methodology of Digital Governance in Municipalities Worldwide.

The Regional web portals are evaluated based on predefined criteria of this index. The survey evaluates websites of municipalities in terms of privacy, usability, content, services, citizen and social engagement. Score differ based on type of the question. For „yes or no" questions, it scales from 0 or 1 to 0 or 3 points in less and more important criteria, respectively and from 0 to 2 (even 3 in special cases) in questions where differentiation is possible.

We evaluated 6 regional web portals using 12 parameters in area of content and services. For instance, we evaluated whether web portal provides: online publications, multilingual access, GIS, calendar of events, searchable database of articles, accommodation reservation etc. All parameters are shown in the Table 1.

3 Results

Department of Information Technologies is interested in web rankings, importance of agrotourism and usage of map portals for a long time (Vaněk et al., 2011). In this article we compared Czech web portals against Austrian and Swiss web portals.

For evaluation of regional web portals, we chose two regional touristic headquarters (Tourist Authority South Moravia (www.ccrjm.cz), Tourist Authority South Bohemia (www.jccr.cz)), one regional touristic web (Posázaví - welcome in the tourist region around the river Sázava (www.posazavi.com)), two Austrian web portals, which represents cross-border cooperation between Austria and Czech republic (Genuine holidays on the farm in Austria (www.agroturistika-v-rakousku.cz), Austria – arrive and revive (www.austria.info/cz)) and official web of Switzerland Tourism Company (www.mojesvycarsko.com)).

From the five possible evaluated areas belonging to methodology of Digital Governance in Municipalities Worldwide, we focused on the areas of content and services.

In the area of content, we evaluated whether web portal contains:

- contact information for regional representation, municipalities, members of LAG (Local Action group), members of non-profit organization, suppliers, stores etc.
- books and publications online
- possibilities of GIS
- multilingual support

- event calendar

In the area of services, we evaluated whether web portal contains:

- newsletter subscription
- searchable database of articles, statistics and surveys
- message board
- FAQ section
- personalize the home page
- accommodation and event reservation
- frequency of website updates

Questions, score scale and evaluation are shown in Table 1.

The highest number of points (20 out of 27) got Posázaví (welcome in the tourist region around the river Sázava (www.posazavi.com)), which obtained full score for immediate updates, searchable databases, newsletter subscription, event calendar and capabilities of GIS.

The 2nd place went to official web of Switzerland Tourism Company (www.mojesvycarsko.com), which got 18 points out of maximal 27. This web portal stands out with its sophisticated booking system, capabilities of GIS and easy to use event calendar including various thematic categories (Family Trips, Cycling, Group excursions, Food and Wine etc.).

Some areas aren't adequately addressed, which is evident from the data in the table. The message board is available only on Posázaví portal, FAQ section and possibility of adapting the site aren't included on neither of them.

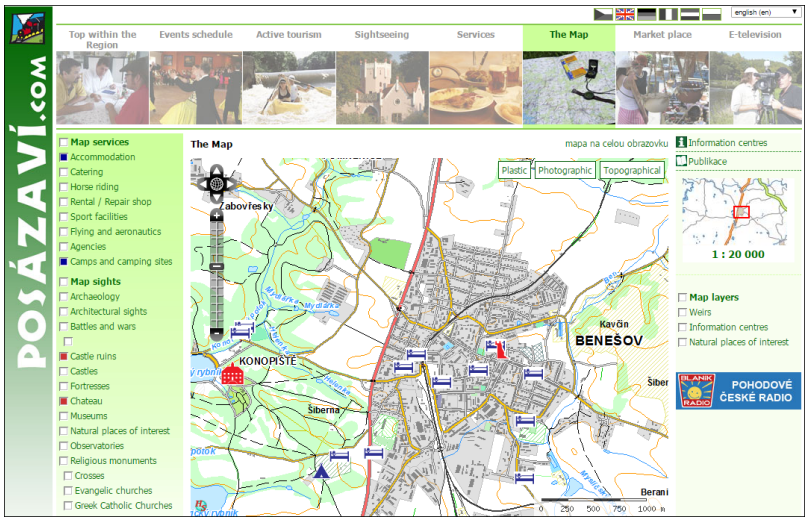

Fig. 1. Regional touristic web Posázaví (www.posazavi.com) – demonstration of possible object selection for map view – accommodation, camps and camping sites, castle ruins, chateau

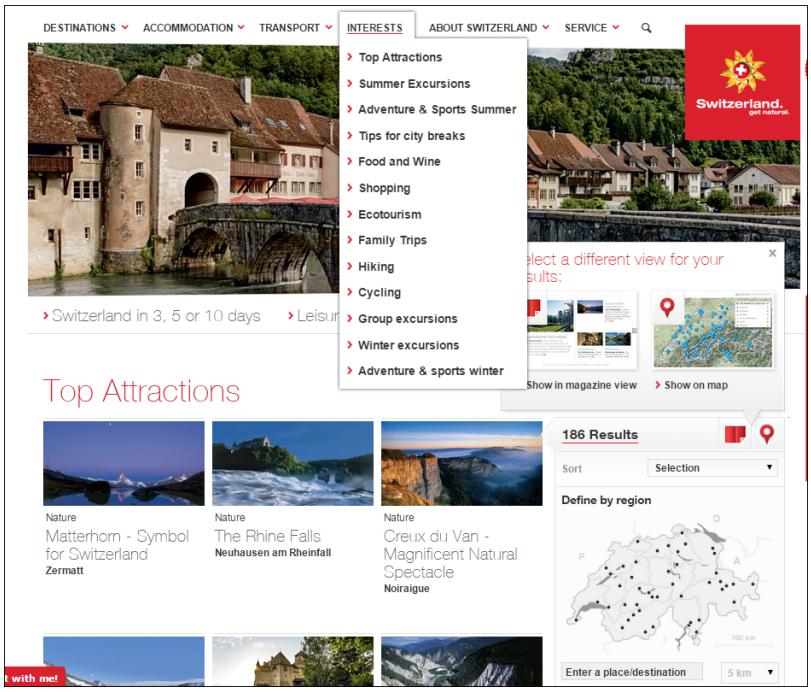

Fig. 2. Swiss touristic portal – menu of interests

Table 1. Evaluation Czech web portals against Austrian and Swiss web portals according to 12 parameters

question	scale	Tourist Authority South Moravia	Tourist Authority South Bohemia	Posázaví	Genuine holidays on the farm in Austria	Austria – arrive and revive	Switzerland Tourism Company
A	0,1	1	0	1	0	0	1
B	0,1,2,3	3	2	2	2	2	1
C	0,1,2	0	0	3	1	0	3
D	0,1	1	0	1	1	1	1
E	0,1,2,3	2	0	3	3	3	3
F	0,1,2	2	3	3	0	2	2
G	0,3	3	3	3	3	3	3
H	0,1,2	0	0	1	0	0	0
I	0,1,2	0	0	0	0	0	0
J	0,3	0	0	0	0	0	0
K	0,1,2	2	0	0	2	2	2
L	0,1,2,3	1	1	3	1	2	2
Total points		15	9	20	13	15	18

Legend:

A - Does the site provide information about regional representation, the municipality?
B - Does the site offer documents, reports, or books (publications) online?
C - Does the site have GIS capabilities?
D - Does the site offer access in more than one language?
E - Does the site offer a calendar of events?
F - Does the site offer registration page newsletters?
G - Does the site offer searchable databases of articles, surveys, statistics?
H - Does the site provide a bulletin board for posting questions?
I - Does the site provide a FAQ (Frequently Asked Questions) corner?
J - Does the site allow users to customize the main city homepage?
K - Does the site allow users to register accommodation, event?
L - How often are the city's website updated?

4 Conclusion

Alongside the unofficial web portals, which points out a certain local attraction, official webs are made. An official site promotes certain geographical area, region or county. We devote our attention in this article to these web sites, evaluate them based

on selected criteria in order that these sites will improve and their next versions will offer more useful information and possibilities for users.

We used methods of “Rutgers-SKKU E-Governance Performance Index”, which is used for evaluating portals of government administration across the world (Gaulé, Žilinskas, 2013). This issue is starting to appear in bachelor’s projects and master’s thesis at Czech universities (Kotala, 2010).

We modified 12 parameters for evaluating regional web sites and used these parameters for evaluation of 6 regional portals. Czech, Austrian and one Swiss web portal were represented. Evaluation brings insight in matter of increasing attractiveness and website traffic of concerned portals, which would lead to increase in visitors of concerned regions.

As it turned out during our model usage, which took into account only two of the important areas (content and services), level of regional web portals significantly differ. Some criteria are fulfilled across the all sites, but some of them are partly or completely missing. Individual solutions therefore often prefer different criteria, thus providing different perspectives on the region and its issues. If all criteria were met, the informational content and thus even usefulness of the individual portals would rise. Theoretically, this would lead to a "content compatibility" of individual solutions, which would ultimately bring profit to users and consequently the visitors of their respective regions.

We will continue to pursue this issue in order to develop methods for evaluating the regional web portals.

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Enhancement of Territorial Products and e-Commerce

Immacolata Viola[1]

[1]Fondazione Simone Cesaretti, via Casaraia, 12, 80049 Somma Vesuviana. Italy,
e-mail: immacolata.viola@gmail.com.

Abstract. The Millennium Goal, namely to halve, between 1990 and 2015, the percentage of population living in extreme poverty and those who suffer from hunger, and the renewed international attention on the effects of the food crisis, have restored centrality to the theme of agriculture and agribusiness in general. It records, today, excessive attention to food production, without a focus on social, economic and environmental impacts of agricultural production and consumption of agricultural products in the face of human pressure[1] (Cesaretti G.P. et al, 2015). Who today can, and should, play a key role in achieving a production that is sustainable socially and environmentally are *small farmers*[2] and new *forms of marketing of products* such as *short supply chain*. The tool that can make a considerable contribution about the spread of information, such as the origin, the organoleptic quality and safety of food products, to the widest possible audience, is the ICT.

Keyword: short supply chain; information and comunication technology; e-commerce; security; traceability; made in Campania.

1 Introduction

The agrifood system is highly developed and widespread and is, by tradition and importance, a distinctive element of the economic system of the Campania. The strength of this sector is due in large part to the wide *variety* and high *quality* of its typical products, as well as the importance of the sectors that make it up and holding a post of prime importance in the national economy. The agricultural cultivations, herds of cattle and pigs, the production of canned vegetables, fruit juices, milk, cheeses, meats and sausages, and also the technologies used in the food industry to create products recognized worldwide. While *quality*, *safety* and *tradition* are the characteristics of the sector.

The exceptional potential of agrifood system is finally enhanced by other positive factors, such as the differentiation of the finished products, the competitive prices on

[1] www.fondazionesimonecesaretti.it

[2] Small producers should receive support through investments in infrastructure, capacity building, knowledge transfer, social protection policies, organization and stabilization of demand.

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the market, the good technological level of companies, the wide availability of workers increasingly trained and qualified.

In the agri-food system in general, and in particular that of Campania, one of the main problems is that concerning the potential changes that may result in the creation of a product. The European Union in recent years, in order to make a greater contribution to the protection of the consumer, including in response to major crises of food security, has enacted a body of law very complex and stringent.

In support of this, it is to consider the commitment of the information society and new technologies to ensure and communicate to a wider audience as possible the source, the organoleptic quality and safety of food products and should be lived and used as a means to link the "producer" and "consumer". Today, thanks to ICT can computerize all this.

It is therefore necessary to reflect deeply on how it will change the agricultural world and more generally the agrifood in the passage from an economy of production in an economy mainly determined by the technology.

2 Made in…Campania

The Campania agrifood boasts several firsts internationally.

The agricultural model field has, in fact, won the top positions not only in the quality and uniqueness of the production, but also in value added per hectare of land (Viola, 2014). Productions bells have also acquired also the primacy of *food security*, with a record 99% of regular samples of fruits, vegetables, wine and oil, with chemical residues below legal limits.

As for the leadership in the typical products, the food system of Campania is one of the most important components of the regional economy, boasting a broad basket of products, many of which are protected by national and international brand. Campania, in fact, is distinct from other regions of the South for the presence of about 28 products including DOC, DOCG and DOP, to which must be added another 300 traditional products of different territories. The number of food businesses registered with the Chamber of Commerce is very high. Firms in the sector, in the area, offer the best Italian, possessing, in their organization, notable features such as: experience, mastery, authenticity, traditions, ancient crafts, culture of doing, can create products high quality and tradition. Not surprisingly, many of the several quality products closely linked to the traditions and the specificity of the territories of origin have gained recognition of a community trade mark. The agrifood is characterized above all by highly specialized production both fresh and transformed: the mild climate enjoyed by the region generally, is, in fact, can get high quality products, competitive compared to national and foreign, with a calendar of very large offer made by the possibility of so many crops in open field and in protected environment. Most of the food Campania products are the stars of the culinary tradition typical of the countries of the Mediterranean basin and southern Italy in particular, universally known as the "*Mediterranean diet*". Linked to the sun, the sea

and the land, this type of power is based on the consumption of simple products: bread, pasta, olive oil, wine, vegetables, fruit and vegetables, supplemented by small quantities of products of animal origin, such as milk, cheese, eggs, meat and especially fish, but rich in beneficial health properties, which for centuries have marked the kitchen of the rural populations in the South.

Campania has surely a wealth of food only for variety and quality, rightly recognized since ancient times: the Greeks and Romans recognized the superiority of the wines and the purity of olive oil from Campania Felix.

The enhancement of local products is an effective strategy for achieving multiple objectives of both economic (revitalization of traditional crops, diversification of production, acquisition of new markets, etc.) and socio-cultural (recovery of traditions and culture local, strengthening local, etc.). It is based on specific potential of an area know-how, traditions and cultures that give the products their specific image (typical) and an economic activity that requires precise identification of potential market outlets, the definition and 'implementation of business strategies and compliance with a requirement: quality.

3 The Short Supply Chain and Enhancement of Territorial Production

The Campania agrifood has an unquestioned commitment to quality. This is true not only for the considerable reputation of the gastronomic traditions, but also thanks to agricultural commodities and their great variety, due to a mix particularly happy and diverse environmental conditions and historical and cultural sedimentation (Carbone A., 2006). In particular, the richness and variety of gastronomic traditions bells represent undoubtedly the strengths on which to leverage, in a growing appreciation of the traditional products, diversified and with a strong content of *typicality*. It is commonly accepted that, for the agri-food system in Campania, to focus on *quality* - from time to time in an agreement or in some of its multiple meanings - is an obvious choice to regain a competitive edge in terms of productivity (Carbone A., 2006).

The establishment of quality and typical food products by consumers is largely conducted at the time of consumption. Of course, consumers prefer to make their own choices in the presence of as much information as possible in order to restrict the margin of uncertainty about the quality of the goods purchased and the sourcing of raw materials. This implies that for the promotion and enhancement of the quality agro-food enterprises bells must activate specific forms of communication and promotion (Verbeke, 2005).

An alternative route for the exploitation of certain food products is that they are marketed on so-called short chains. Short supply chains, in the various forms in which it declines, are expressions of the will of the actors involved to build different forms of sales compared to conventional circuits of production-consumption, aggregating and involving different subjects around values, principles, goals and meanings which environmental, cultural and ethical (Whatmore e Thorne, 1997;

Marsden et al., 2000; Hinrichs, 2000; Holloway e Kneafsey, 2000; Goodman e DuPuis, 2002; Sage, 2003a,b; Renting et al., 2003; Ilbery e Maye, 2005; Kirwan, 2004 e 2006; Brunori, 2007). A common feature of these circuits is the willingness / ability to give the food a significance that goes far beyond that of simple consumer goods. Examples of short supply chain are: the direct sales company, shops collectives of farmers, farmers' markets, the various forms of buying groups, e-commerce. By examining these configurations we realize that it is not easy to define it unique. In fact, the concept of short supply chain incorporates at least three dimensions of proximity: geographic proximity, social and economic (Galli, Brunori, 2013).

Short supply chains were identified originally as examples of farmers' resistance to modernization and then globalization of the food system (Van der Ploeg et al., 2000). Through greater proximity with consumers, farmers can develop autonomous strategies of marketing based on differentiation, which allow to keep it this way a larger share of added value within the company or the local economy. These strategies are often based not only on proximity, but also on the transmission of values '*alternative*' incorporated into the product, such as sustainability (environmental, but not only), biodiversity, cultural tradition, solidarity. In recent years, these initiatives are proving more and more interest on the part of individual producers and producer groups but also by consumers for a number of reasons, such as the fact that the short channels have the merit to have suffered a minor number of passes through intermediaries that lengthen the time between the completion of the production process and consumption. The long supply chains, in fact, make it necessary to make storage and keeps reducing the freshness of the product and may adversely affect the organoleptic and nutritional properties and, in extreme cases, the healthiness.

A result not least, the long and complex route taken by the products along the traditional industries, is also the least clarity on the origin of products, and sometimes it is less certainty of raw materials (Lamine, 2005). The opportunity to know directly the producers and the geographical origin of the product is seen by some segments of the question, as a form of indication to quality assurance of the goods. In addition, some consumers appreciate the opportunity to support, in this way, local small businesses.

Finally, the limitation of transport and the number of steps can have a restraining effect on prices, which grow progressively as we approach the final ring of sectors, namely the distribution which, in virtue of the power marketIt owns, manages to capture a substantial portion of the added value created in the chain.

As for manufacturers, product placement on short chains, therefore, has the advantage of allowing the acquisition of a larger share of added value. Next to this, there is also the possibility that a more direct contact, and in a sense more personalized, with consumers is a prerequisite for a relationship of trust and long-lasting that helps to increase the stability of commercial outlets.

Evidently, next to some advantages, these modes of commercialization also meet some significant difficulties, especially for the purpose of the adaptation of the requirements of demand - both as regards the definition of the quality profile of the product with regard to the temporal synchronization between supply and demand and

for all services to be incorporated in the product - but also for the organization of the functions of sale and / or delivery of goods.

The pooling of some of these functions with other manufacturers may be an opportunity to overcome the difficulties that arise, as well as to increase the visibility of individual firms, it is a necessary condition for the enhancement of quality by consumers. Increasingly in recent years, groups of farmers manage in common the relationship with customers along the short supply chain thus increasing the range of the offer and offering a joint service of delivery, or in the workplace, which simplifies the management of purchases from customers.

4 Strategy Digital Business: e-Commerce

Among the most advanced types of short supply chain, there is no doubt e-commerce.

The term e-commerce refers to the exchange of goods and services through the use of Internet. Understood in the strict sense, e-commerce is expected that the transaction is that the payment should be sent electronically; understood in a broad sense however, there even if the order is done online but the payment is offline (A. Foglio, 2010).

According to the European Commission: *Electronic commerce covers many different activities, such as the sale of goods and services electronically, the online distribution of digital content, electronic transfer of funds, (...) the online selection of suppliers, marketing direct services for the consumer, as well as the after-sales service. In e-commerce includes both products and services that new activities".*

Depending on whether the operators of the interaction are commercial company, a private or public entity, defining different types of e-commerce. In particular:

• Business-to-business (B2B): includes commercial transactions between companies in the network involving services and industrial goods. Transactions of this type are implemented via extranet, a private network that allows you to extend the boundaries to other selected companies, thanks to connections via the Internet protected and for the exchange of information and cooperation;

• Consumer-to-consumer (C2C): it consists of the transactions between consumers through the network.

The set up of an e-commerce is the activation of a new sales channel that has two additional advantages compared to the traditional ones: a head, as the site is active 24 hours a day, seven days a week and a advantage of geographical, as a site allows you to sell to consumers in any part of the world. The customer also has the option to access a wide and diverse choice both in terms of product characteristics for both the price: you can find unusual products, specialist, amateur, niche simply by using search engines. As we have said, with e-commerce buying process is changed, switching from a linear, one-way to a multi-channel, characterized by a network of interdependent activities. Another success factor for e-commerce are the tools of CRM (Customer Relationship Manager), which help in the collection and analysis of quantitative and qualitative data, allowing the user profile to include consumer

choices, buying preferences and behaviors. The data collected allow the mapping of the purchasing behavior of our customers and better identify their needs, enabling the company to take advantage of this information to target supply and after sales service.

4.1 e-Commerce and Traditional Products of Campania

According to P. Cuccino, 2007, compared to the products, e-commerce reveals a double reality: on the one hand, products must be flexible enough to allow some adaptation to the tastes of different consumers; on the other, as it allows to operate globally via the Internet, e-commerce is a strong stimulus to the expansion of currently reduced percentage of products sold anywhere without adaptations.

In this dual context, various types of local products in category Made in ... Campania, are particularly suited to e-commerce, such as consumer goods brand easily identifiable. Made in ... Campania must therefore express their excellence to exploit the opportunities arising from e-commerce and acquire leadership positions undoubtedly within his reach in an international context characterized by a still incomplete exploitation of the potential of electronic commerce.

Build an interactive platform, e-commerce, it has many advantages including: promoting and spreading towards the Italian and foreign consumers the great food tradition territorial bell; promote the internationalization of the operators from Campania; encouraging networking initiatives between local agri-food businesses in order to give support to the creation of the critical mass required to successfully compete in the international markets.

An example of e-commerce for the enhancement and promotion of the typical products of a territory, such as that of Campania, is the portal "Agribusiness of the Campania Region." The portal space is managed by the industry in order to tell their own reality, their own productions and events that organize the territory. A meeting place, then, to know the products, their history, those who produce them and where they can find and the quality of the productions themselves, the raw materials, the culture, the organoleptic qualities and finally security. Among the products promoted and valued on the portal there are cheeses, spirits and liqueurs, fresh pastries and bakery products, vegetable products, etc., which are the result of a complex evolutionary process of contraction and interaction between local producers, and between they and the local population and with consumers and local citizens when the system opens to distant markets (Belletti et al, 2006).

5 Conclusions

Focus on quality and the close link with the territory, it is increasingly the first choice for businesses agribusiness Campania, which implies the adoption of strategies aimed at enhancing and promoting. This involves a number of difficulties are not trivial, especially when those involved are numerous and heterogeneous between them, in terms of structural and production specialization.

In other words, the different strategies of commercial promotion of food quality, not always turn out optimal in providing adequate safeguards for consumers, or in ensuring a better market position and better economic performance for operators. Hence a possible solution is to take in the short chain, is e-commerce. The e-commerce is that particular form of exploitation and promotion of local products aimed at consumers "sensitive" to the product that counts among its features a strong bond with the territory of origin.

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ICT as a Catalyst for Innovation Diffusion

John Dalrymple[1], Barry O'Mahony[2], Elizabeth Levin[3] and Steven Greenland[4]

[1]Swinburne Business School Swinburne University of Technology, Melbourne, Australia, e-mail: Jdalrymple@swin.edu.au
[2]Swinburne Business School Swinburne University of Technology, Melbourne, Australia, e-mail: bomahony@swin.edu.au
[3]Swinburne Business School Swinburne University of Technology, Melbourne, Australia, e-mail: Elevin@swin.edu.au
[4]Swinburne Business School Swinburne University of Technology, Melbourne, Australia, e-mail: Sgreenland@swin.edu.au

Abstract. The availability of water is a global issue which is predicted to become more pronounced in the future. As a large and relatively dry continent Australia is presented with a series of challenges within the agriculture sector. As a result, the adoption of appropriate, efficient and effective irrigation systems is an important element for future sustainability. In various Australian growing regions different modes and types of irrigation are utilized. However, in many cases the preferred system has been selected based on tradition and local norms rather than on the basis of effective water management. Consequently, there is a socio-psychological element in the adoption of new or alternative systems. This study reports on a project that identifies how the introduction of technology within a variety of irrigation systems types has improved water efficiency, reduced wastage and improved product adoption. In particular the study discusses how technology has improved the use of flood and micro irrigation systems as well as more recent developments in satellite assisted irrigation. The findings of the study suggest that the enhancement of existing irrigation systems through the addition of information communications technology can overcome some traditional barriers by adding specific features that are attractive to growers.

Keywords: Irrigation, extension workers, innovation diffusion, water management

1 Introduction

Australia is a large land mass with a current population of just over 22 million people. However, the agricultural sector is frequently challenged by drought and a general lack of available water, which has led to the need to irrigate vast holdings of land using a variety of methods. These include Flood, Centre Pivot, Sprinkler and Surface and Sub-surface Drip irrigation systems. The selection of the most appropriate system has been found to depend, to some extent, on crop type, however, barriers to the uptake of the most efficient and effective systems have also

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been found to be based on traditions and local norms. In some cases this has meant that wasteful irrigation methods have prevailed such as flood irrigation where evaporation accounts for up to 30 per cent of wasted water.

At the same time, Australia has a well-developed agricultural sector, with farmers deemed to be extremely innovative in the methods they have used to overcome the harsh local growing environment (Sheehy, 2012). The Australian agricultural sector is also among the least subsidised in the world which has hastened the introduction of innovations in line with the world's best practice, particularly in the production of commodities. This has resulted in a surplus of food year on year (Keogh, 2012). However, the adoption of efficient irrigation systems such as drip irrigation has been relatively poor despite many benefits such as less water used or wasted, uniform targeted water delivery and higher crop yields.

Among the issues related to the availability of water in the future is an expected increase in global food needs based on population growth which is expected to reach over nine billion by 2050 (Food and Agriculture Organization). Australia is a major food exporter and has aspirations to be a significant player in the supply of food to the Asian region in the future (Mascitelli and O'Mahony, 2014). Indeed, Australia has been tipped to become the future 'food bowl of Asia', a phrase that recognises the importance of the food and wine industries as a major driver of future foreign exchange income (Maher, 2014). In Australia there are opportunities for further growth in food production through the opening up of new land to farming, however, this would require significant improvements in agricultural practices as well as in land and water management.

The aims of this study were first to gain a deeper understanding of the influence of publicly available information on the adoption of the most efficient and effective irrigation systems. The second aim was to examine how technology has been used to improve the efficiency and effectiveness of some traditional systems by reducing water wastage. The final aim was to establish how contemporary information and communications technology could enhance the adoption of more efficient and effective irrigation systems.

2 Methodology

The first phase of the study involved a desk top review of both academic and practitioner literature, together with government reports and websites that offer advice on the choice of irrigation systems. In this review a number of barriers to adoption of agricultural products and practices were identified.

The second phase involved site visits to explore how the technology enhanced irrigation systems were operating in various farming regions as well as a series of qualitative interviews with government agricultural advisers. These advisers, who are also known as extension workers, are technically trained, holistic thinkers who are able to deal with complex technical situations. Their role involves farmer education relating to the application of scientific research to agricultural practice. The final phase was to examine how information and communications technology

was helping to overcome some of the barriers to innovation in the use of the more efficient and effective irrigation methods.

3 Findings

The content analysis conducted in the first phase of the study found that tradition has a strong impact on the irrigation system types that are presented to those accessing information and there are distinctions between states, regions and soil types. The emphasis on what is generally practiced in various regions has meant that some psychological barriers would need to be overcome in order to convert farmers to different systems that might be more efficient and/or effective for their crop and soil type. For drip irrigation for example, issues highlighted within this review included the cost and complexity of system installation and a lack of information about the return on investment and a series of other advantages of these systems.

The review also highlighted a number of factors that impede the adoption of sustainable practices in farming. Among these are barriers relating to available information, which includes general information, such as information about the product, product benefits, economic benefits and technical information. In summary, it was found that there are four key influencers and trusted sources of information about irrigation for farmers. These are other farmers, agronomists, field days and the Department of Primary Industries (Bates et al., 2008).

In the second stage of the study, it was discovered that he Victorian Government has provided incentives for famers to prepare 'whole farm plans' for their properties, so farmers have a better understanding of the way water is used and retained within their farms. Extension workers assist farmers to develop, enact and update these plans. The Victorian State government and the Australian Federal Government have also invested heavily in water distribution infrastructure for flood irrigation and technology which supports a reduction in the footprint of irrigation. Whilst the benefits of connecting to the new infrastructure have been clearly demonstrated, joining the new system is voluntary.

The government investment has been, for the most part, investment in open channel water distribution systems. That is the traditional method used to deliver water to flood irrigation systems. The investment involved funding the repair and improvement of the distribution channels, which, of itself, would not have provided farmers and growers with greater utility. However, the deployment of modern ICT systems together with the careful application of solar generated electricity has significantly enhanced the utility of the government investments for farmers and growers. This is because, with modern, well designed systems of gates and valves, sufficient power can be generated by modest solar generating systems to establish autonomous systems that are not dependent on mains power. In one region of Northern Victoria, this has resulted in the deployment of flume gates that integrate sensors and flow meters which, when combined with a supervisory control and data acquisition (SCADA) systems, enable accurate flow measurement, flow control , power supply and radio telecommunications to be integrated into a single device that can be controlled from the water authority computer. The farmers and growers can program their irrigation from their desktop or tablet via the water authority ICT systems.

These farmers are predominantly growing pasture crops. The technological advancements that have been installed have provided a significant advantage to flood irrigation over more modern irrigation methods. This sort of automation is

not, however, restricted to open channel flood irrigation systems that are controlled by the water authority and their sophisticated ICT systems. Any of the fixed irrigation systems, such as drip irrigation and subsurface drip irrigation that involve pumps and valves can, with appropriate sensors and interfaces, be automated through the use of modern ICT systems. For example, young, tech savvy farmers who are interested in improved lifestyles as well as being environmentally conscious are keen to adopt the latest technology which can provide them with real-time information relating to water availability as well as moisture content of the soil on their farms.

Whilst the government provides incentives and support to improve irrigation practices, there still remain those who are risk averse and reluctant to automate their irrigation systems. This may be addressed by the development of soil moisture measurement devices and wetting front detectors that can make measurements that can be transmitted using modern ICT devices. The incorporation of these developments can provide confidence to the farmers and growers by field testing the systems and observing their performance before progressing to rely on the systems to perform reliably. Once that confidence is achieved, farmers and growers will be more likely to use ICT controlled systems to manage their irrigation systems.

Confidence is obviously a major issue in the adoption of new approaches and methods to farming practice. In California, researchers have developed satellite imaging systems that have been coupled with terrestrial sensors and on farm crop data to provide an integrated system that provides decision support to farmers and growers in their quest to provide irrigation water in the correct quantity in the correct location and at the correct time. Developments in all areas of information and communications technologies as well as many other technologies have clearly been essential to enable this development to be achieved.

In Australia, a project is currently underway to continue a development program that will build on the crop measurement capability (Abuzar, et al., 2015). The Victorian State Department of Environment and Primary Industries (DEPI) has funded this project to integrate the satellite data, weather data from the Australian Bureaux of Meteorology and ground level data from lysimeters, soil moisture meters and rain gauges (Whitfield, et al.,).

The integration of these measurements through sophisticated ICT systems has the potential to enable a full picture of the crop water requirements. This information system can then be linked to efficient irrigation systems that can deliver the irrigation water in the correct quantity, at the correct time to the correct location. The system is designed to provide information to the Eastern Seaboard of Australia with the ability to deliver at the level of an individual paddock. Once this system is fully developed, a phase of confidence building will be required that assures growers that the system delivers enhanced production and reduced running costs on a reliable basis. The building of such confidence will, of course, place a heavy burden on the reliability of the ICT information supply chain that drives action in the paddock.

4 Conclusion

Previous studies have shown that the social infrastructure of the Australian agricultural environment has an impact on new product adoption and that a farming subculture generally develops within regions which influence farming styles. These developed norms can be difficult to change despite evidence of improvements provided by new products. As a result, the key issues that need to be overcome when introducing new products in the farming context include both economic issues (profitability) and peer acceptance.

While, change agents have been found to be particularly important in addressing the culture and traditions of farming, there is some evidence to suggest that the novelty and ingenuity of innovations in ICT can help to overcome cultural norms while improving the efficiency and effectiveness of irrigation systems especially when these improvements have a positive impact on individuals' lifestyles.

Important networks influencing change include federal and state level agencies and the scientific community who support various land care programs, as well as local agencies, interpersonal networks, industry and community groups and farmers/growers. Membership and participation in formal and informal groups has also been shown to have an influence on individuals. Within these groups farming styles, which have been described as a cultural repertoire, take hold and are communicated between farmers and this directly influences agriculture practice. Addressing these groups may lead to positive changes in the adoption of irrigation products.

This has highlighted the need to engage other stakeholders to test these assumptions and to modify the research approach to gain the most comprehensive information possible. The ultimate payoff will be to open up new swathes of arable land for the production of food crops and dairy and livestock production. The capability of the Australian continent to produce much more food is not limited by the available land, nor the available water, but by the distribution of the available water and its management and use. The development of reliable information supply chains based on the integration of reliable ICT systems that can contribute to the management of the available water resources and irrigation systems will be a major contribution to the fulfilment of the potential of Australia as a major food producer for the rest of the world.

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