CAPAS: A Service for Improving the Assignments of Common Agriculture Policy Funds to Farmers and Land Owners

Mariano Navarro[1], Ramón Baiget[1], Jesús Estrada[1] and Dumitru Roman[2]

[1] TRAGSA Group, Conde de Peñalver 84, 28006, Madrid, Spain
{mnc, rbl, jmev}@tragsa.es
[2]SINTEF, Pb. 124 Blindern, 0314 Oslo, Norway
dumitru.roman@sintef.no

Abstract. The Tragsa Group is part of the group of companies administered by the Spanish state-owned holding company Sociedad Estatal de Participaciones Industriales (SEPI). Its 37 years of experience have placed this business group at the forefront of different sectors ranging from agricultural, forestry, livestock, and rural development services, to conservation and protection of the environment in Spain. Tragsa is currently developing a business case around the implementation of a Common Agriculture Policy Assignment Service (CAPAS) – an extension of a currently active and widely used service (more than 20 million visits per year). The extension of the service in this business case is based on leveraging new cross-sectorial data sources, and targets a substantial reduction of incorrect agricultural funds assignments to farmers and land owners. This paper provides an overview of the business case, technical challenges related to the implementation of CAPAS (in areas such as data integration), discusses the current solution and potential use of rule technologies.

Keywords: property data, data integration, "greening" economy, rules

1   Business Case

As an introduction for CAPAS business case, it is appropriate to quote from the European Commission Common Agricultural Policy (CAP) funding web page:[1]

"For the last 50 years the Common Agricultural Policy (CAP) has been the European Union's (EU) most important common policy. This explains why traditionally it has taken a large part of the EU's budget, although the percentage has steadily declined over recent years. […]

The European taxpayer rightly expects that these sums are correctly spent. It is therefore of paramount importance that management and checking systems are in place which give reasonable assurance that the sums are spent properly and that any irregular payments are detected and recovered."

---

[1] http://ec.europa.eu/agriculture/cap-funding/index_en.htm

Developing on that idea, the CAPAS business case extends and improves an existing service of CAP funds assignments, developed by Tragsa for the Spanish public administration, farmers and land owners, with the purpose of achieving a better and more objective assignment of funds. The current service[2] is based on data provided by various stakeholders and suffers from the following problems:

- *To public administration:* Data submitted by rural banks or owners is often incorrect or inaccurate. The result is an unfair grant assignment and expenditure on audits.

- *To farmers and land owners:* If their "kind of crop" or "Areas of Ecological Interest (AEI) surface" specification is inaccurate, it will turn out in incorrect grant assignments (close to 30%).

The current service is widely used in Spanish rural areas and has more than 20 million visits per year. Typically, it is used directly by land owners and, more often, by rural banks, rural labor unions or SMEs that hire their services to land owners. These existing users will continue to be an important target group for the extended service. The opportunities to internationalize the extended service powered by a better algorithm based on new data sources are very clear due to the fact that it solves a common challenge that is present in all similar Common Agricultural Policy funds assignment services in Europe and beyond. It is important to note that there is a CAP funds assignment service in each Ministry of Agriculture of each European Member State. Some examples include:

- *Austria:* AgrarMarkt[3]

- *Belgium:* Flanders - Agentschap Landbouw en Visserij74; Wallonia - Ministère de la Région wallonne, Direction générale Agriculture[4]

- *Bulgaria:* State Fund Agriculture - PA for the Bulgarian RDP[5]

- *Slovenia:* Agency of the Republic of Slovenia for Agricultural Markets and Rural Development[6]

- *Spain:* Fondo Español de Garantía Agraria (FEGA)[7]

Currently, the assignment of funds is based on several parameters provided by human operators, whose work is mainly concerned with ortophotos, satellite and aerial images, and interested parties such as the land owners. For example, "pasture admissibility" (a percentage defining if a specific parcel is suitable or not for grazing) or "irrigation coefficient" (a percentage defining the irrigated surface ratio) are input variables of a business rule that modifies the funds assigned to a given farmer or company.

---

[2] https://www.fega.es/PwfGcp/es/ayudas_dir_desa_rural/aplicacion_sigpac/index.jsp
[3] http://www.ama.gv.at
[4] http://www.vlaanderen.be/landbouw
[5] http://www.dfz.bg
[6] http://www.arsktrp.gov.si
[7] http://www.fega.es/PwfGcp/es/

Fig. 1. An example

In the Figure 1 above, there are two highlighted/shaded parcels. For the upper-right shaded parcel (in pink), the "pasture admissibility" value is equal to 100%, while for the lower-left shaded parcel (in white), the "pasture admissibility" is equal to 0%. Even at first sight, it becomes evident that soil type and tree distribution is quite similar. The origin of that difference is irrelevant: the mentioned parcels are very close, but they could have been processed by different operators, or, maybe one of the owners could have requested a modification for the defined values. This case shows a good example of a situation that results in incorrect funds assignments and would need to be investigated/fixed by subsequent audits.

Furthermore, not all input variables that define funds assignments rules are very clear. In the new *Europe 2020 strategy for growth in the European Union,*[8] a new set of input variables and rules are stated for the assignment of funds. Some of them are:

- *Diversification* of crops: some crops, for example, are proved to be better dioxide carbon fixer;
- *Maintenance* of existing permanent pasture;
- *Ecological focus areas* (EFA) on farms (determined by each member country within the categories established by the EU);
- *Sustainable,* based on a greener economy ("greening"), and a more effective and competitive management of resources.

The definition of a parcel or farm "greening" value is open to interpretation. Nevertheless, it should be as objective as possible because it is going to define a large proportion of final funds assignments. Quoting the UK government: "Farmers are required to implement 'greening' measures by EU rules, or they will lose up to 30%

---

[8] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=URISERV:em0028

of their Basic Payment Scheme payment. The greening rules cover three areas – crop diversification, Ecological Focus Areas, and measures to maintain permanent grassland."[9]

Therefore, defining an objective set of rules based on observable variables is mandatory to build the new CAP funds assignment services as error-free as possible in order to obtain the fairest compensation for farmers and land owners.

Thankfully, all the required data to define ecological focus area surfaces, kind of crops or grassland cover is already available. Therefore, the main task of CAPAS business case is to share new, and often underused, datasets and cross check the references in order to obtain a clearer and better picture of crops state. Due to the use of some of these new datasets, development of new processing algorithms and business rules are needed.

Henceforth, CAPAS Service is being designed as an improved version of the existing service of Common Agriculture Policy funds assignments[10] to farmers and land owners by making better use of data related to agricultural and urban ownership, together with environmental and biodiversity data, creating a new product with added value to those provided by the producers of these data. This will also create innovative services and new and features which will provide an easier management, integration and reuse of data.

Value Proposition. The focus of the CAPAS business case is to publish and integrate multi-sectorial data from several sources into an existing data-intensive service targeting better and fairer Common Agriculture Policy funds assignments to farmers and land owners. The goal is to leverage data integration from several sources to better calculate the funds assignments.

2   Technological Challenges

The main challenges related to the datasets considered in the CAPAS business case context are that some of them are relatively large and it is not evident how they can be set up and prepared to be processed by the existing algorithms. Another difficulty is that the datasets are highly heterogeneous and data formats are diverse (SQLite, MS SQL Server, Esri Shapes, RDF, .LAS and .LAZ LIDAR files, etc.).

In addition, data comes from several and varied sources, and from different sectors: biodiversity, earth observation, administrative information about the types of crops, property data, etc. Consequently, the capabilities needed to achieve a new improved CAP service based on new, cross-sectorial data will be related with the treatment of large amounts of data in different formats.

As depicted in Figure 2, the main technological challenge in CAPAS Business Case is the dynamic process of integration of several external data sources in order to obtain a definition of parcels parameters as objective as possible.

---

[9] https://www.gov.uk/government/news/cap-greening-criteria-announced
[10] http://sigpac.mapa.es/fega/visor/

The goal is to leverage data integration facilities to properly implement the new set of rules defined by European 2020 strategy.
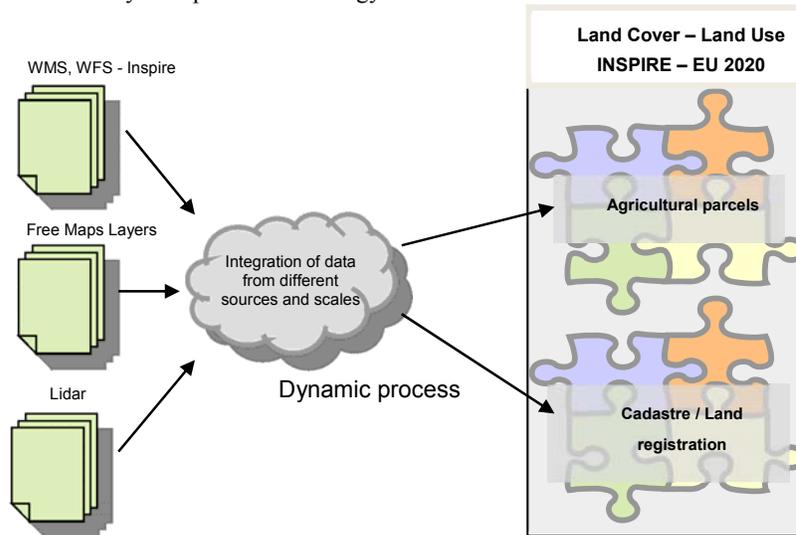

Fig. 2. CAPAS Business Case General Architecture

The CAPAS business case is based on several groups of data. Some of them very well know and adequately exploited. In this case the challenge is related to their dynamic processing:

- Public administration data about parcel information and statistical data (MAGRAMA – Spanish ministry of agriculture, INE – Spanish statistical office, Data from Autonomous Regions)[11]
- Spanish national geographic institute (IGN) data about land cover and land use[12]
- Information provided by owners, hosted by MAGRAMA & Tragsa Cadastre information[13]

Other datasets are underused or unfamiliar. For example, LIDAR[14] data is a very powerful source for earth observations. It is in the order of TBs and could be considered, properly, as Big Data.

---

[11] http://wms.magrama.es/wms/wms.aspx?SERVICE=WMS&VERSION=1.1.0&REQUEST= GetCapabilities

[12] http://centrodedescargas.cnig.es/CentroDescargas/index.jsp

[13] http://www.catastro.meh.es/default_eng.asp
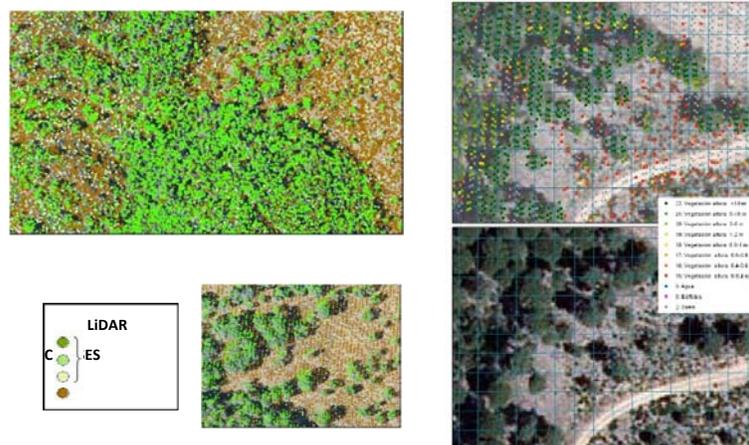
[14] http://en.wikipedia.org/wiki/Lidar

Fig. 3. LIDAR points ranked Vegetation and Soil

As shown in Figure 3, LIDAR point clouds not only show an accurate description of relief and elevations, but also a precise identification of vegetation height. This parameter, processed together with images (shape of treetops, leaves colour, etc.) give a clear idea of vegetation type.

After data collection and data processing is completed, it is time to use the data to define properly, objectively, and without errors, all the input variables that will be used in the *funds assignment rules*.

Unfortunately, defining the crops and parcel variables and parameters is not an immediate process and it involves several parameters such as:

- Soil characterization
- Vegetation cover parameters
- Crop diversification
- Type, density and surface of Ecological Focused Areas
- Proximity or overlapping to Sites of Community Interest (SICs)
- Proximity or overlapping to natural parks and protected sites
- Proximity of overlapping to Special Bird Protection Area

Some examples regarding the rules applied are:

Crop Diversification: "A farmer must cultivate at least 2 crops when his arable land exceeds 10 hectares and at least 3 crops when his arable land exceeds 30 hectares. The main crop may cover at most 75% of arable land, and the two main crops at most 95% of the arable area."

Kind, density and surface of Ecological Focused Areas: Maintaining an "ecological focus area" of at least 5% of the arable area of the holding for farms with an area larger than 15 hectares (excluding permanent grassland) – i.e. field margins, hedges, trees, fallow land, landscape features, biotopes, buffer strips, afforested area. This figure will rise to 7% after a Commission report in 2017 and a legislative proposal.

3   Rule-based Approach

Rule technologies have a high potential for addressing the technical challenges in this business case. Specification and implementation of business rules can assist in the process of data integration and eventually decision making for funds assignments. In order to achieve a certain level of automation in this process, machine-readable rules (in rule languages such as RuleML, SWEL, R2RML, F-logic – depending on the required expressivity and tool support) need to be created and implemented. The sources of such machine-readable rules vary, with rules defined in legal documents being predominant. The following reference documents are sources for the rules based on which this business case relies.

Europe 2020 strategy for growth in the European Union: The Commission presents the strategy that should enable the European Union (EU) to achieve growth – it aims at "intelligent, sustainable, inclusive growth" with greater coordination of national and European policy.

Draft Law amending the Law 42/2007 of December 13, natural heritage and biodiversity changes (Spain):[15] One of the most important changes introduced by the law is the incorporation of environmental information in the Registry of Property. With this option, the aim is to give greater legal certainty of property ownership within protected areas, so that environmental information affecting these spaces has its reflection in the Land Registry.

PAC (common agricultural policy) 2015 – 2020. Practices beneficial for the climate and environment. Conditionality:[16] This document defines the beneficial practices for the climate and environment and will define the funds assignment rules in CAPAS business case. Specially, CAPAS will systematize the decision making in regards of:

- *Diversification* of crops: Checking current and historical data.
- *Maintenance* of existing permanent pasture.
- *Ecological focus areas (EFA)* on farms (determined by each member country within the categories established by the EU). Examples of queries to be answered include: Are there EFAs in a specific parcel? How large are they? What is the surface ratio between arable lands and EFAs surfaces?
- *Conditionality*: This concept is diffuse and open to interpretation – obligations relating to the environment, good agricultural condition of land, public health, vegetation health and animal health and welfare. The landscape elements to be preserved and that will define the Conditionality include field margins, trees in group, trees in line, isolated tress, hedge, woods, groves, etc.

As already highlighted, the agricultural funds assignment is a complex process currently open to subjective interpretation that could generate unfair assignments of funds. A corollary is the high audit costs related with inaccurate assignment spent by

---

[15] http://www.magrama.gob.es/es/biodiversidad/participacion-publica/Borrador_Modificaci%C3% B3n_Ley_42_2007_tcm7-346812.pdf

[16] http://europa.eu/legislation_summaries/agriculture/general_framework/l60002_es.htm and http://ec.europa.eu/news/agriculture/111012_es.htm

Public Administration. In order to avoid this, a set of business rules need to be developed paying attention also to all legal boundaries and restrictions.

By using rules technologies for supporting the data integration task and the procedure for assignments of funds, the CAPAS business case will provide the Spanish Public Administration with a powerful new approach and tool oriented towards a better service for land owners and a better use of public funds. Technically, this will be achieved through the use of new datasets (currently underused) combined with new processing algorithms and the definition and use of rules based on several legal restrictions.

4 Results

The results of cross-use of several and different data sources is a more accurate definition of soil, crops and vegetation description that will reduce significantly the need to rely on data provided by funds receivers and replace it with more 'objective' data that can be collected and integrated from different cross-sectorial sources in a more automated way.

Currently, and using the tools and datasets already available, TRAGSA has developed an improved version of CAP viewer, offering several new layers to farmers and land owners, as shown in Figure 4.
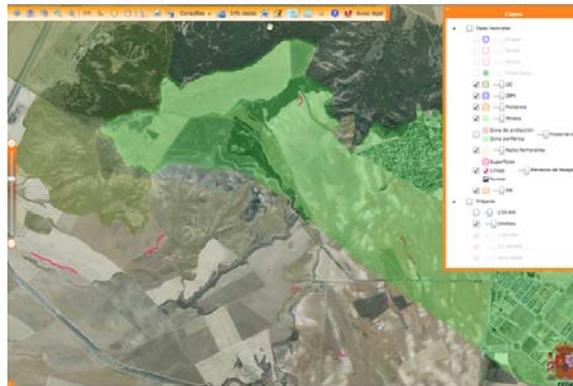

Fig. 4. CAP Spanish Viewer

Analyzing aerial images, TRAGSA has created a first version of Ecological Focused Areas layer, allowing owners to know if a specific section of their parcel could be considered as EFA and how big the sections are.

Other layers developed and published include:

1. Permanent pasture
2. Landscape elements
3. Crop protection products (pollution produced by)

Therefore, TRAGSA is currently developing new information layers based on pre-existing datasets that will be improved with the information coming from new sources as LIDAR. These new static layers could be considered as a draft version of the CAPAS Dynamic stage (see Figure 2) that will offer improved data dynamically.

All this information will be the input parameters for the Business Rules that will define, eventually, the CAP assignments for a specific farm and its owner.

5   Importance and Impact

Due to the fact that data submitted by rural banks or owners could be incorrect or inaccurate, the Spanish public administration has to devote several resources to audit the data in order to avoid an unfair assignment of funds. In the same way, an inaccurate specification of the kind of crop or the surface of the Areas of Ecological Interest (AEI) turns out in incorrect grant assignments for owners.

The Official Journal of the European Union reports[17] that the overall incorrect grant assignments funded by Member States, in 2012, was more than 230 Million Euros. This amount has to be recovered from the Member State to European Union. As a specific example, UK will have to return 10.3 Million Euros due to incorrect identification of type of crops. With the use of the improved CAPAS algorithm, this Member State could save, directly, a total amount close to 7 Million Euros, not including audit expenses and administrative charges. Furthermore, several paying agencies from 5 other European countries (Denmark, Germany, France, Romania, and Spain) will be subjected to later clearance decisions.

This new improved service developed as part of this business case is expected to have the following impacts and outcomes:

- *Exploitation and Valorisation* of cross-sectorial data sources;
- *Publication* and use of currently collected but unused datasets in the distribution of funds algorithm;
- New data processing algorithms over *LIDAR* Big Data;
- *Cadastre and Ownership* information enriched with biodiversity information: Species distribution, Sites of Community Interest (SICs), Special Protected Areas for Birds (SPABs), etc.;
- *Implementation* of European 2020 CAP funds assignment rules.

The CAPAS business case is expected to improve substantially the efficiency and competitiveness of the widely used existing service, by integrating more datasets, currently unused. As a result, the Spanish administration and citizens will obtain more accurate information regarding rural and agricultural parcels. The ownership information, enriched with environmental information as EFAS (Ecological Focus Areas) will allow owners to request different kinds of Common Agricultural Policy funds

---

[17]   http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32013D0209&qid=1397837441272

and this request will be validated and justified by objective and reliable rules and information.

On the other hand, the opportunities to internationalize this improved service powered by a better algorithm based on new data sources are very clear due to the fact that it solves a common challenge that is present in all Common Agricultural Policy funds assignment services in Europe.

The main direct customer for this improved service is the current customer, the Spanish Ministry of Agriculture, which in turn offers it to land owners or, more often, to rural banks, rural labour unions or SMEs that hire their services to the land owners. These actual users will continue to be an important group, but will not be the only ones. In this sense, all Ministries for Agriculture in the Member States could be interested in this improved service. Furthermore, this transfer process is not new to Tragsa. Due to the administrative organization of the Spanish state, the CAP fund assignment tool is the result of a merging process of several regional funding services. In addition, the Global CAP platform is finally transferred and adapted to regional agencies[18] in order to use and improve local features. In addition, the use of rules and advanced algorithms for Big Data processing in order to determinate accurate land use and land surface will be useful not only in agricultural environments, but is also a powerful tool that could be applied to other domains such as: cadastre reports, property taxes, land classification (urban land, development land or land not for development, etc.).

Through its International Unit, Tragsa Group operates in a wide range of countries including Portugal, Poland, Romania, the Russian Federation, Morocco, Tunisia, Egypt, Angola, Syria, The Dominican Republic, Mexico, Panama, Brazil and Paraguay. Overseas, Tragsa Group cooperates on a regular basis with the Spanish Agency for International Cooperation, the European Commission, the Interamerican Development Bank and the World Bank. The internationalization of the group facilitates the exploitation and dissemination of results through meetings, conferences, publications and websites and the exportation of the final products to new markets. Tragsa is planning to use this connection to its International Unit to further promote and exploit the CAPAS service.

---

[18]
   https://www.fega.es/PwfGcp/es/ayudas_dir_desa_rural/aplicacion_sigpac/sigpac_visores_au
   tonomicos_236.jsp