An Integrated Indicator Based Knowledge Evaluation System for Sustainable Tourism Management in Greece: Empirical Approach of Multiple-criteria Decision Analysis Making for Future Tourism Spatial Planning

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Abstract. Indicators are a modern tool for measuring and identifying the quality of goods such as tourism and recreation in a region. Index systems have been established throughout Europe and almost all over the world to present thematic directions through an evaluation of the current situation and analysis of the features that relate to prospects for sustainable development. The purpose of this paper is to present a system of tourism sustainability indicators for Greece which is the only one available that is highly detailed and shows the diversity and the new dimensions for tourism projects and studies. The results of this study highlight the importance of such a system for a country, especially concerning an area with tourist attraction to make it possible for the area to endure in the future, based on institutionalized strategies and goals.

Keywords: Tourism Management; Operation research; Decision Support System; AHP; Delphi.

1 Introduction

Leisure activities and tourism concepts, which comprise part of the developmental process of the Greek state, according to Soutsas et al. (2006) can be used for the regional development and the evaluation of the factors contributing to the development and design of an area. The tourist characteristics of the Greek Prefectures present a dynamic attraction for visitors and lead to the formation of tourist flows, thus, creating a spatial background of cross-regional policy with economic, social, ecological, environmental, and cultural cohesion (Polyzos and Arabatzis 2008a,2008b). It is now perceived that spatial analysis and sustainability surveys for tourism (Curry and Luiz, 1992) have been applied in countries around the world since tourism is identified as a key to the multi-thematic development (cultural, residential, environmental, urban planning etc.) of a region (Xiao, 2013).

Taking into account the United Nations Agenda (2030), which is a plan of actions and salvation for humanity, the planet and prosperity, Environmental Resources comprise one of the 17 statutory goals (GOALS) of sustainable development on which the Member States must focus at both the local and global level and in turn, exploit

sustainably and rationally by preserving and restoring sound ecosystems (services, functions, values), to contribute to the mitigation of the chain of values of life and the phenomenon of climate change (United Nations General Assembly, 2015;United Nations Environment Assembly of the United Nations Environment Program, 2016;The 2030 Agenda for Sustainable Development).

It should be noted that sustainable tourism and sustainable tourism development are the most important cross-cutting objectives and comprise an integral part of the United Nations Agenda 2030. More specifically, a tool that the Institution anticipates and encourages to be developed and used is that of the indicators which reflect a milestone in the success of a global shift towards sustainable development (Economic and Social Council United Nations, 2017;The Sustainable Tourism Program of the 10-Year Framework of Programs on Sustainable Consumption and Production Patterns; The Sustainable Tourism Program committed to driving the change, 2015).

According to the guidelines and Special Indicator Charts issued by the European Commission (2020), research models can be identified as social, environmental, tourism, and financial ones reflecting tailored country-specific impact strategy analysis criteria.

What is more, Greece must proceed to a tourist portfolio by creating landscape levels and systems, spatial analysis, modelling of tourism demand, and economic environmental valuation in order to be able to defend itself by preserving its identity in line with what commands the future of Europe, the next scientific development and generation, as well as the economy. In addition, not only direction models have to be followed but also the relevant directives and regulations of the European Parliament and the Council of Europe, should be updated by the Greek state. From Greek Ministry of Environment Energy and Climate Change (2013), it can be inferred that areas with special forms of tourism and sophisticated features need to be rebuilt and supported in order to achieve sustainable development and avoid the mythology and degradation of the product. Therefore, modification and revision of Greek Ministry of Environment Energy and Climate Change (2013) should bring the desired effect and curb weaknesses in the country.

It is the aim of this research to create a system of tourism sustainability indicators for Greece in order to forecast and define the strategies to be followed in particular areas. After all, the ultimate goal of this research is the introduction and establishment of a new tourism assessment tool for the future management of the tourist product considered, as well as for purposes of decision making of suitable scenarios for interventions in recreational areas and in the natural landscape.

2 Methodology - Sample

The sample size for the population of the Prefecture of Pella was estimated based on the types of Simple Random Sampling (Zerva et al. 2018; Tsiantikoudis et al. 2013). In effect, the sample size is 382 people and is representative of the general socio-economic conditions of the local population.

2.1 Sustainability Indicators

In this section we present the evaluation of impact (AHP) in pairs along with the analysis of effect (Delphi) that were constructed by encompassing the variables used and which are the following with a consistency of significance of incidence more or less (Srdjevic and Srdjevic 2011;Chen et al. 2013;Latinopoulos and Vagiona 2013;Srdjevic et al. 2017;Vasileiou et al. 2017)

A) Larger significant impact has values of: 1-3-5-7-9 (higher significance): 1=equal incidence, 3=weak effect & 9=absolute prevalence of incidence when the evaluation takes place bottom up.

B) Less significant impact is given by:1-1/3-1/5-1/7-1/9 (lower significance) when the evaluation takes place top down.

For the evaluation of the above we constructed the following:

C) Vulnerability indicators showing whether there will be endurance and resistance in the scenario, take values: (-1,0,+1).

D) Insight indicators reflecting the respondent's sense of how the scenario should be applied in the near future, take values: (0 and+1).

E) Objective Crisis Indicators referring to the confidence interval of the survey, receive values: (-1,0,+1).

G) Sustainability indicators referring to the sustainable application of the scenario over time, take values: (-1,0,+1).

Finally, CI & CR and λmax were estimated according to the following formulas (Gao and Hailu, 2012;Etongo et al. 2018):

$$CI = (\lambda max-n)/(n-1) \qquad (2)$$
$$CR = CI/RI \qquad (3)$$

It is worth mentioning that other methods of multicriteria analysis have been rejected (such as the PROMETHEE Group, the ELECTRE Group, the DEA Method & Linear Programming) as they are mostly applied according to the available literature with the financial data and the quantitative data that they deal with. It needs hardly be argued that TOPSIS was rejected on the grounds that it is the MCDM method that is used for the formation and mechanism of food production, supply and logistics of the food market, and not for tourism and sustainable tourism development, and economics of the environment, and values & preferences (Arabatzis and Grigoroudis 2010;Arabatzis et al. 2010;Velasquez and Hester 2013;Lima et al. 2014); Vlontzos et al. 2014). Finally, for the influence matrices, the positive and negative effects scale (Jose, 1996) was used with ascending and descending order respectively of panel values of (high negative effect) -4,-3,-2,-1,0 (no effect) and (high positive effect) +4,+3,+2,+1 (Siomkos, 2004). The decision-making system implemented could not have been completed without the significant presence and extraction of the indicators for tourism, which ultimately paved the way and the light to be given to the region so as to bring significant benefits to users and to smooth out environmental, social, and

economic problems. After all, land use transformations in a spatial framework of analysis encompass the contribution and presence of human activity as a whole.

The following figure shows the analytical scopes for the sustainability indicators for tourism at all levels, that were applied and followed in order to produce the best intervention scenarios eventually.
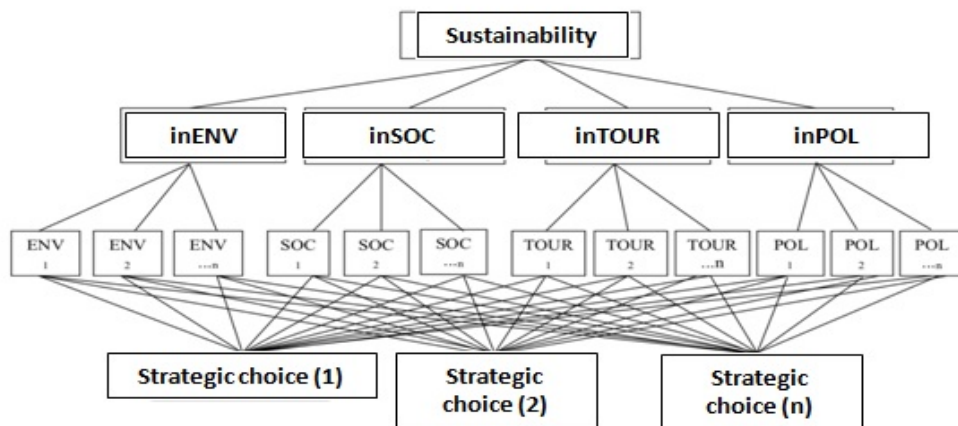
Fig. 1. Decision Making System of Sustainability Indicators.

Coding of DSS,
Level1 = Sustainability
Level2 = inENV, inSOC, inTOUR, inPOL
Level 3 = Environmental Indicators, Socio-Economic Indicators, Tourism Indicators, Policy Indicators
Level4 = (1,2...n) Choice Strategy
Strategy1: Creating Jobs and Employment.
Strategy2: Absorption and Increase of Investments.
Strategy3: Reconstruction of Cultural and Natural Heritage Identity.
Strategy4: Land Usage & Sustainable Management of Environmental Resources.
Strategy5: Planning and Landscaping.
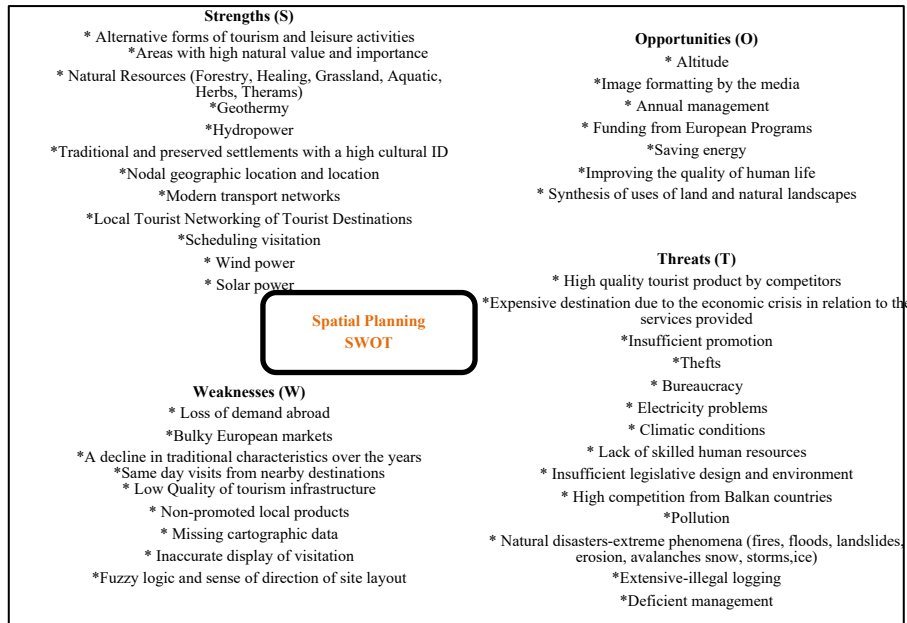Strategy6: Development of projects and programs.
Strategy7: Programming of Recreational Values.

3 Research Area

The research area selected was the Thermal Springs of Pozar and the Voras Ski Center (Pella Regional Unit-Greece). What follows is the analysis of the area concerning its spatial design combined with the natural environment, tourism,

economy, society and the characteristics forming a comprehensive background of an analysis of strengths, weaknesses, opportunities and threats.

Table 1. Spatial Planning of alternative forms of tourism in the research area.

Strengths (S)	**Opportunities (O)**
* Alternative forms of tourism and leisure activities	* Altitude
*Areas with high natural value and importance	*Image formatting by the media
* Natural Resources (Forestry, Healing, Grassland, Aquatic, Herbs, Therams)	* Annual management
*Geothermy	* Funding from European Programs
*Hydropower	*Saving energy
*Traditional and preserved settlements with a high cultural ID	*Improving the quality of human life
*Nodal geographic location and location	* Synthesis of uses of land and natural landscapes
*Modern transport networks	
*Local Tourist Networking of Tourist Destinations	**Threats (T)**
*Scheduling visitation	* High quality tourist product by competitors
* Wind power	*Expensive destination due to the economic crisis in relation to the services provided
* Solar power	*Insufficient promotion
	*Thefts
Spatial Planning SWOT	* Bureaucracy
	* Electricity problems
Weaknesses (W)	* Climatic conditions
* Loss of demand abroad	* Lack of skilled human resources
*Bulky European markets	* Insufficient legislative design and environment
*A decline in traditional characteristics over the years	* High competition from Balkan countries
*Same day visits from nearby destinations	*Pollution
* Low Quality of tourism infrastructure	* Natural disasters-extreme phenomena (fires, floods, landslides, erosion, avalanches snow, storms,ice)
* Non-promoted local products	*Extensive-illegal logging
* Missing cartographic data	*Deficient management
* Inaccurate display of visitation	
*Fuzzy logic and sense of direction of site layout	

4 Results

The corresponding indicator weights and the Consistency Index & Consistency Ratio estimators according to mathematical modelling and the Random Consistency Index parameters for each indicator are presented. In the results of Level2 of the AHP analysis, social indicators are identified as having the most weighing and priority with the ones of the environment following next. However, moving to a next stage, it is found that new criteria have to be taken into account in shaping the area. The indicators of the scenario showed a promising outcome for the region.

priority vector (Weights)
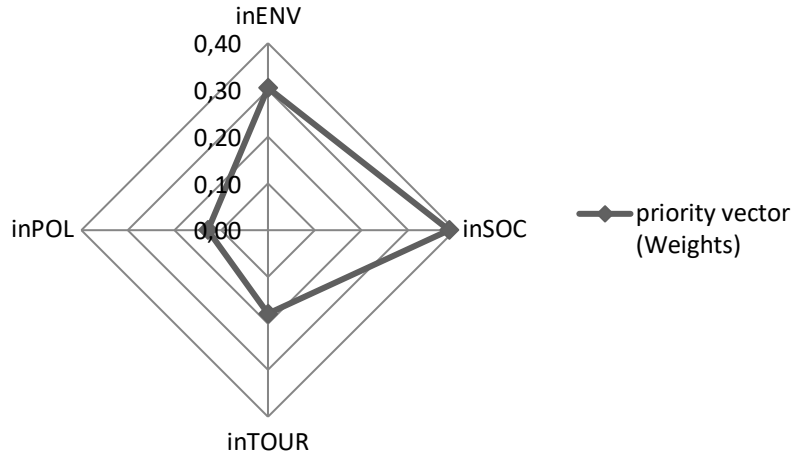
Fig. 2. Weights of four-dimensional Indicators.

The results from level 3, highlighted not only the critical parameters that were taken into account in the planning of the tourist package and plan but also the interventions that need to be implemented. Particular attention needs to be paid to the outcome of the results on environmental indicators, and especially on RES which showed a consistency of responses and high weight of sustainable choice for the region. Also, concerning the tourist indicators, the second strand of each market and labor indicator offered an important finding while the policy indicators highlighted the importance of the state on this issue. Finally, the scales of insights, viability, objective judgment, and vulnerability have graphically depicted the implementation of the scenarios and the kilometer distance on index impact. What is also noteworthy, is the last core which was formed with reference to all the indicators in an application with the corresponding λmax & CI & CR.

The last part of the AHP analysis was completed with the analysis strategies for each indicator. At this stage, the highest level of details is presented, with the results being valuable to the design of the product. Most of the indicators have shown consistent and sustainable results with a sustainable CR estimate of <10%, which also highlights the involvement of the respondents in the project coordination. In particular, the following environmental indicators did not receive high weighing: inFOR1, inFOR3, inFOR7, inFOR9, inFOR12, inFOR14, inFOR17, inRAN1, inRAN2, inRAN3, inGAME1, inGAME3, inWET1, inWET3, inWET5, inWET7, inWET8, inWET9, inRES2, inRES4, inSPA1, inSPA2, inSPA3, inSPA5. From the Social and Economic Indicators, the inSOC7, inSOC8, inSOC10, inSOC11 did not indicate consistency and impact weighing. However, only one parameter, the one of competition, inTOUR1, seems to be of no particular concern to the respondents, which

highlights a high-quality tourist product without the risk of competition. Finally, concerning the policy indicators, inPOL13 & inPOL15, the responses provided suggest that no strategy is needed. The remaining criteria have demonstrated strong interpretable components of the direction that should be given to the region. It is worth mentioning that this research is the only one that examines the tourist status of a region and provides the maximum level of detail on the goals to be set for sustainable development in Greece.

GOAL
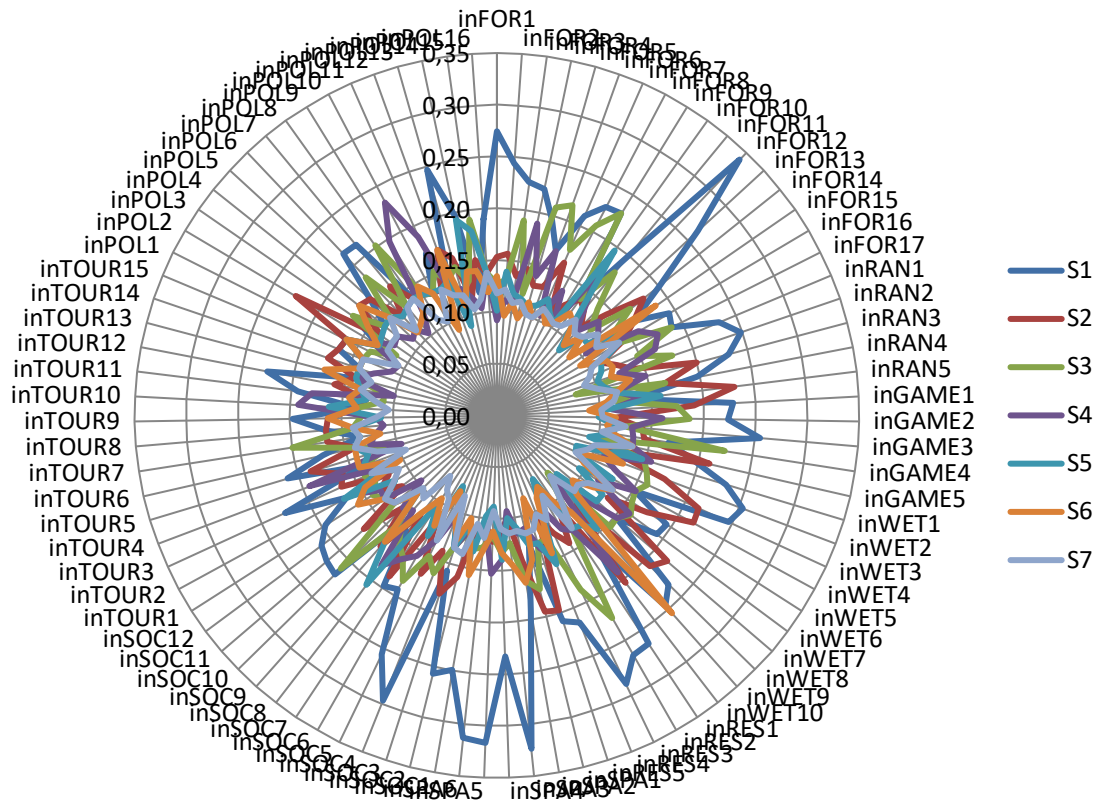
Fig. 3. Indicators of inSTORM Strategy Action.

The results showing the effects of the Delphi method at the specific analysis level in the area of tourist interest under consideration are presented graphically in the light of the dimensions of each indicator which was applied. Of the six regions in total, the 3, the Ski Center, the Airport and the Wetland, appear to be influenced by the system

of indicators applied. In particular, the R^2 values showed high correlations between the kilometer distances and the effects exercised according to the sample responses (0.865 and 0.8824, respectively).
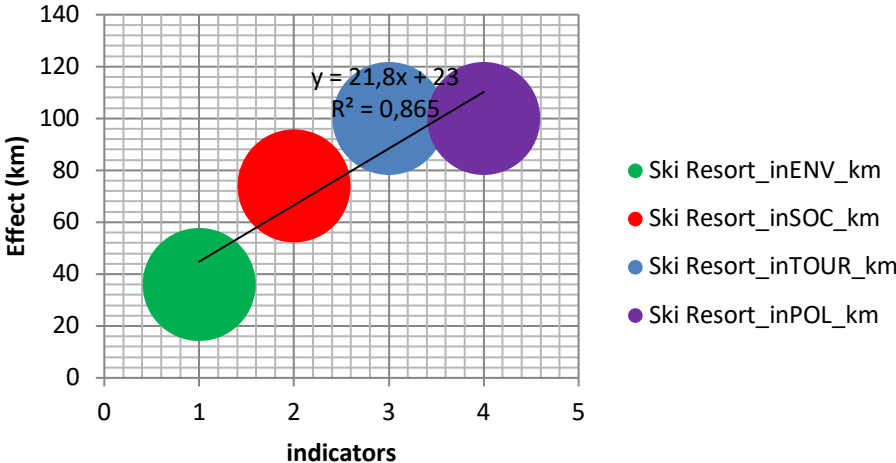
Fig. 4. Effect of Indicators on kilometer distance to the ski center.
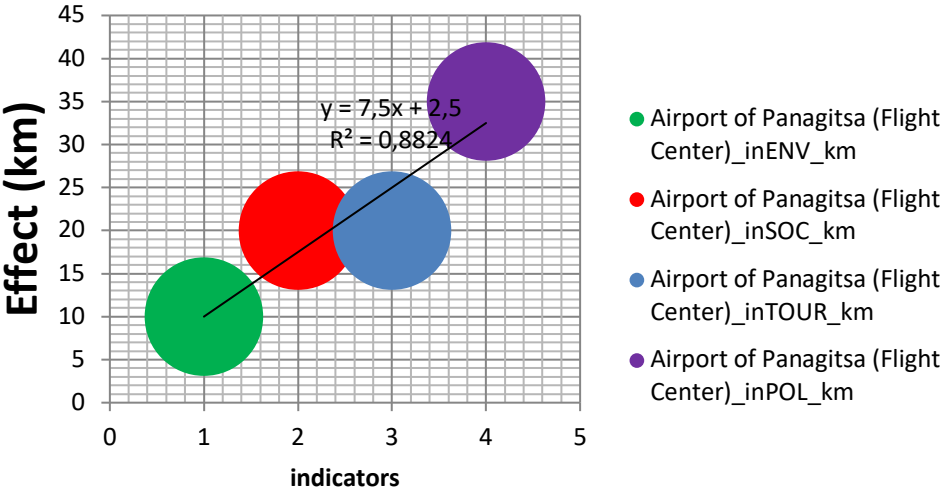
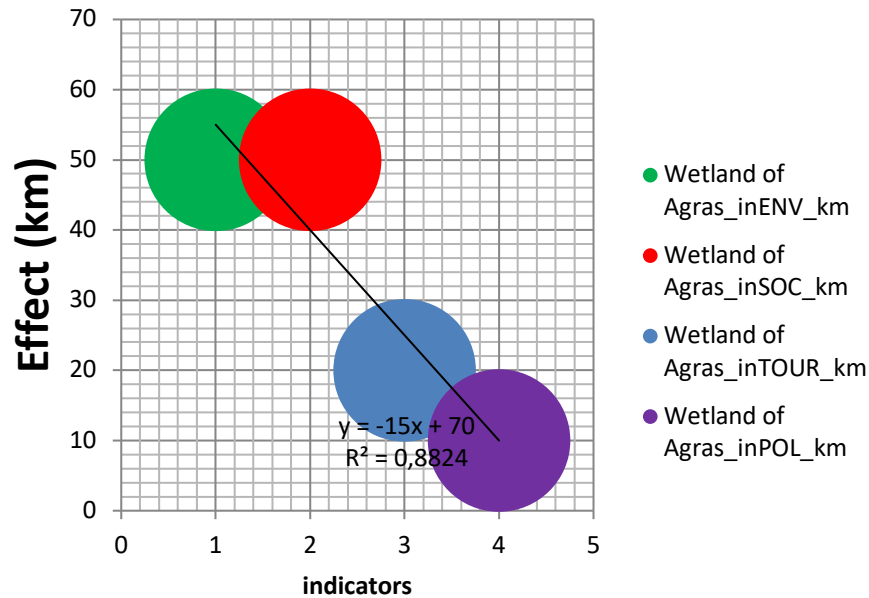**Fig. 5.** Effect of indicators on kilometer distance from the airport.

Fig. 6. Effect of Indicators on Kilometer Distance to the Agra Wetland.

5 Conclusions

The results show how sustainable management of the Voras Mountain can be achieved through different scenarios of tourism intervention, which are in line with the European model and strategies set by the European Commission concerning climate change.

The results of this research present new knowledge about the region and the Greek area, but also updated, and improved the existing ones informing the international literature on the subject as well. It has, therefore, become clear that a unified plan should be created for these areas with particular tourist patterns. Over the years, local regulation and society are regarded as the key to change and reform. The findings have a key role and significant value for research, management, environment, economy, spatial planning and policy since demand for recreation has a significant impact on the market and sustainability indicators for tourism have been unknown in these areas so far (future research paths).

The present research presents some key credible and valid supremacies such as the focus of research planning and the research contribution, the motivation of the study, the methodological support of the findings, its position in the existing subject field. Furthermore, there is strong consistency between the goals, the findings and the subsequent discussion (theoretical and empirical integration). In particular, the research presented the tourist value of a leisure pole, that had never been investigated previously, introducing a massive pillar of indicators (indicators for Sustainable

Tourism Management-inSTORM) with different dimensions and offering an excellent design of interventions in the area along with their organization, resulting in the contribution of the results to the initiation of a new dialogue and the development of a new framework for tourism.

Currently, all public services have the knowledge and expertise as well as all the necessary information tools which enable them to make their own tourism management studies and intergovernmental tourism boards. Not only in Greece at the local and regional level but also internationally, all countries should adopt legislation (Horizon Europe 2021-2027), a standard management system for tourism and sustainability, the same way that it has taken place for the forest, water and climate.

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