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CONTENTS

USE OF MULTICRITERIA ANALYSIS AND GIS FOR SELECTING SITES FOR ONSHORE WIND FARMS: THE CASE OF ANDROS ISLAND (GREECE)

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ABSTRACT

Since wind power is one of the most promising sources of Renewable Energy (RES), the number of wind farms installed around the world is constantly increasing. The aim of this paper is to develop a mechanism for determining and evaluating the suitability of areas for siting wind farms, using a combination of Multi-criteria Data Analysis and Geographic Information Systems (GIS). This study was carried out on the island of Andros, Greece. The process involved a four-step gradual exclusion of unsuitable areas for siting wind farms and an evaluation of compatible areas using criteria both from this country's institutional framework and international literature. During the evaluation of available areas, using the Analytic Hierarchy Process (AHP), pairwise comparison is used in which the weightings were determined by a group of experts. Despite the very favourable wind conditions on Andros, only a small percentage of its total area was given a high score for siting wind farms, due to the strict constraints imposed. The proposed methodology for the optimum siting of wind parks can be used in any study area and at any planning scale (local, regional, national level).

Keywords: analytical hierarchy process; geographical information systems; Greece; onshore wind farm applications; site selection

Introduction

Energy is related to almost all human activities and forms an essential prerequisite for the economic and social development of a country. Ensuring an energy supply has resulted in numerous countries worldwide adopting renewable energy technologies.

Wind power is a form of renewable energy that is expected to be a widespread commercial success. According to experts' predictions, wind power could capture 5% of the world energy market by the year 2020, if supported by superior economics and improved technologies (Lee 2009).

Wind power is developing at an extremely rapid pace around the world, while the siting of wind plants for its exploitation is a major issue and at the centre of a debate involving the international scientific community. This fact is reflected in the large number of scientific papers written on the subject of the siting of onshore wind parks at a global scale. The process of siting an electricity-producing plant, which runs on wind power, comprises a range of parameters described using environmental, social and economic data, which for its determination primarily requires the use of computing systems.

Geographic Information Systems (GIS) have proved to be a useful tool for estimating the potential of renewable energy regionally (Hoesen and Letendre 2010; Gil et al. 2011) and as a decision aiding tool in energy planning (Clarke and Grant 1996; Voivontas et al. 1998; Domingues and Amador 2007). Furthermore, the production of visualization maps in GIS has facilitated the contribution of researchers, policy makers, investors and citizens in the integrated renewable energy planning approach.

Numerous studies worldwide aim to evaluate compatible areas for the siting wind farms, by combining GIS with multi-criteria analysis (e.g. Kazim et al. 2015; Latinopoulos and Kechagia 2015; Watson and Hudson 2015; Höfer et al. 2016; Noorollahi et al. 2016). Although a variety of multi-criteria decision methods (MCDM) exist, a review of combined GIS-MCDM methods concludes that the AHP method is the most widely used technique in sustainable energy studies (Pohekar and Ramachandran 2004).

The aim of this paper is to create an integrated methodological approach for the identification and prioritization of the most suitable sites for wind farms on the island of Andros, in Greece. The specific study area was chosen due to the strong interest in siting wind farms on this particular island, mainly because the wind conditions there are very favourable. However, despite the large number of wind farms on this island, currently only one has an operating license, mainly because they are unacceptable to the local community on Andros.

In practice, the procedure for siting wind farms in Greece is most commonly based on an exclusion approach, which is based on the legal framework of the Special Framework for Spatial Planning and Sustainable Development for Renewable Energy (SFSPSD-RES) (SFSPSD-RES 2008). There are also some scientific studies (Voivontas et al. 1998; Tegou et al. 2010; Mourmouris and Potolias 2013; Xydis 2013; Tsoutsos et al. 2015; Latinopoulos and Kechagia 2015; Panagiotidou et al. 2016) that refer to Greece. The present study focuses on an island where despite the advantage of the wind potential, the deployment of wind farms raises strong social reactions.

This work reveals the state of the knowledge on the siting of onshore windfarms in order to improve the in-

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tegration of renewable energy into electricity generation. Scientific databases are investigated and the main issue addressed in terms of both exclusion and assessment are included in the analysis.

The present paper contributes to the existing literature on the deployment of onshore wind farms in various ways. GIS and AHP are integrated in order to develop a framework for selecting sites for wind turbines. GIS is used as a data extraction and measurement tool, while MCDA (AHP) serves as an evaluation tool. Existing renewable energy infrastructures as well as the minimum distance from such facilities are considered. Inadequate sites in terms of surface area are excluded from the analysis. Social acceptability is introduced as an evaluation criterion, while pairwise judgements were performed by the authors and local experts.

Materials and Methods

Methodological framework for the selection of sites for wind farms

The process of finding the optimum areas for siting wind farms in a geographical region includes various stages, which are determined by the researcher and do not follow any specific model. In this paper, a combination of applied methods is used, along with innovative elements and criteria. More specifically, at an initial stage, a four-step gradual exclusion of incompatible areas is adopted, based on a large number of criteria (exclusion criteria). Next, areas viewed as suitable are then further evaluated in the second stage, according to a number of criteria (evaluation criteria), while the process also takes into account the opinion of local experts by means of close ended questionnaires. Some of the exclusion criteria are also selected as evaluation criteria, mainly due to their importance and type (economic, environmental, social etc.); their selection is explained in detail below.

The stages and steps of the proposed method are shown in Fig. 1.

In the second stage, an evaluation of the potential areas resulting from the exclusion stage is carried out, in order to identify the optimum areas for siting wind farms on the island. The areas examined at this stage are all viewed as suitable, based primarily on the spatial planning criteria regarding wind farm installation. An attempt is then made to compare the areas available, in relation to technical, economic and social criteria. Within this framework, a multi-criteria analysis of the above-mentioned criteria is carried out, using the Analytic Hierarchy Process (Saaty 1980), whereby the weight of each criterion is determined by the authors and expert engineers from Andros. Upon completion of the Analytic Hierarchy Process, the areas with the highest suitability score for siting a wind farm are identified.

Study area

Andros is the northernmost island in the Cyclades in Greece and second in size to Naxos. It covers an area of 379.21 km^2, with a total coastline of 176 km and a resident population of 10,000 people. It is located between Evoia and Tinos, at a distance of 6 and 1 nautical miles, respectively. It extends from northwest to southeast and has an elongated shape, with a maximum length of 40 km and a maximum width of 17 km.

Andros is primarily mountainous, with verdant ravines, valleys and abundant surface and ground water. The largest part of the island (65%) is covered by rural land, followed by forests and semi-natural areas covering 34%, while artificial surfaces only cover about 1% of the island's total area.

Andros is windy since most of the island experiences winds of 8–10 m/s or even higher than 10 m/s. The only exception is the northern and central part of the island, where the wind speed in certain areas is approximately 7–8 m/s and in a very few places it does not exceed 5 m/s.

Regarding other sources of Renewable Energy according to the Regulatory Authority for Energy, there are no geothermal, solar thermal, small hydroelectric, hybrid or biomass plants on the island of Andros. Permission to build a photovoltaic plant in the northern part of the island was rejected, and there is one wind farm operating on the island.

Stage 1 / Step 1: Exclusion areas

According to Article 6 of the Special Framework for SFSPSD-RES (SFSPSD-RES 2008) and the existing infrastructure and areas in Andros, the areas considered incompatible as regards the installation of wind farms, which are excluded from the outset, are the following:

- point areas: ports, heliport, bathing areas, archaeological sites, listed cultural monuments, monasteries, antennae;
- linear areas: the road network and high-voltage electricity grid;
- extensive areas: Sites of Community Importance (SCIs) and Special Protection Areas (SPAs) of the Natura 2000 network, Areas of Outstanding Natural Beauty (AONBs), settlements, highly productive farmland, quarries and mines.

In addition, the relevant planning also excludes rivers and lakes, i.e. surface water bodies, since it is not possible to site an onshore wind farm within them, (e.g. Bennui et al. 2007; Nguyen 2007; Aydin et al. 2010; Phuangpornpitak and Tia 2011; Zhou et al. 2012). According to the literature, the planning also excludes Wildlife Refuges (Aydin et al. 2010; Watson and Hudson 2015), which are not included in the Special Framework, but are nevertheless considered to be very important for preserving the biodiversity of a region, since it is thought that if wind

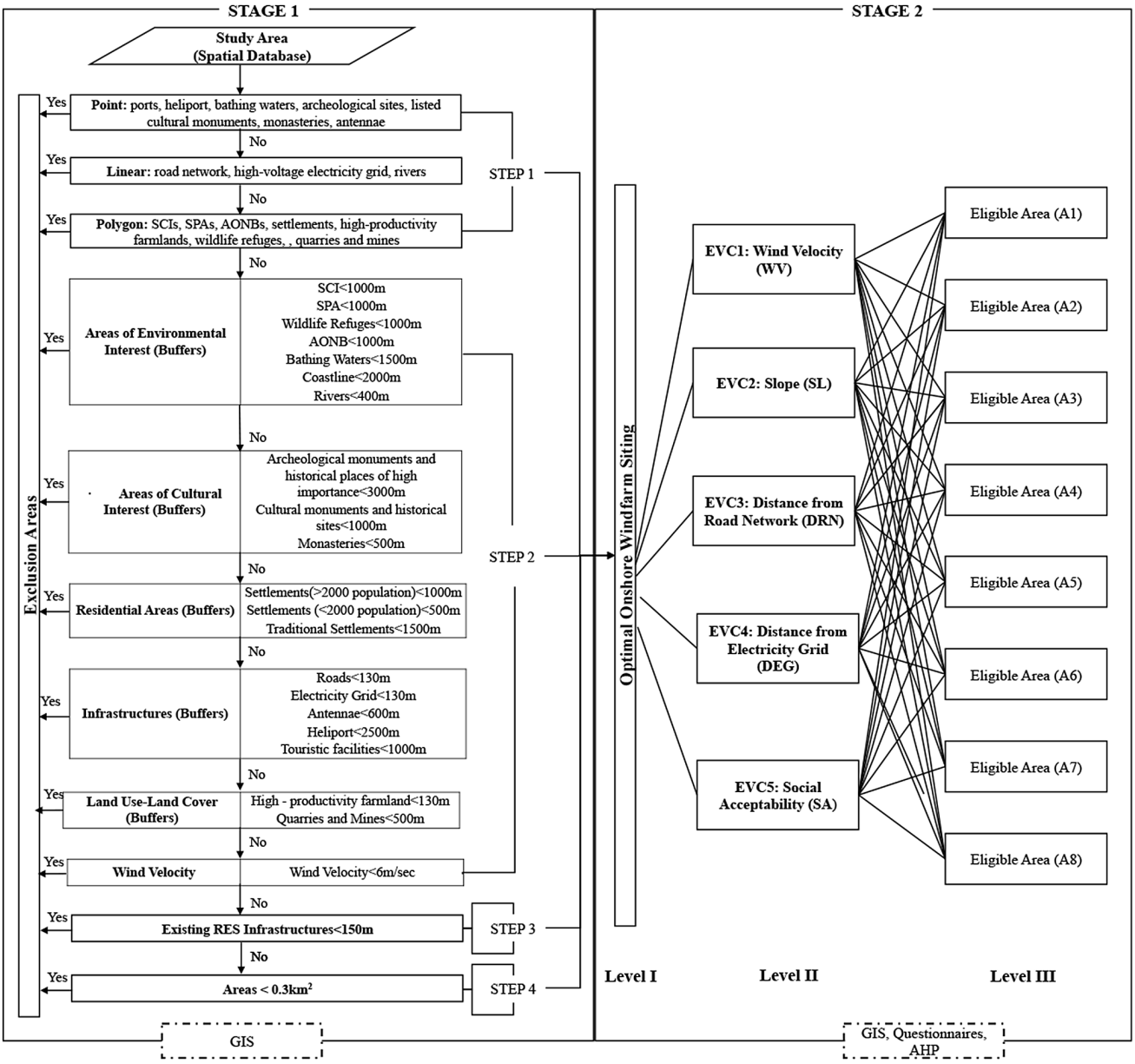

Fig. 1 Flow diagram of the method used.

turbines are installed therein, then this will potentially disrupt the relevant ecosystem.

Stage 1 / Step 2: Incompatibility zones

In order to determine the minimum distances from excluded areas and incompatibility zones for siting wind farms, the relevant national legislation is taken into account, i.e. SFSPSD-RES (SFSPSD-RES 2008), as well as the distances mentioned in international literature.

Table 1 lists the criteria included in the present analysis.

Stage 1 / Step 3: Existing RES infrastructures

After excluding the incompatible areas and setting the minimum distances in Table 1, the most suitable areas for the siting of wind parks are identified. Nevertheless, these specific areas may include some already used for RES infrastructure, which either are in operation or have a production license, an installation license, are undergoing assessment or have been rejected. For this reason, at this stage, the present study excludes all areas used for existing RES facilities, and obviously parts of these that may exist within the areas deemed suitable for siting wind farms in the previous stage.

In addition, the SFSPSD-RES (SFSPSD-RES 2008) defines a distance of 2.5 d (d is the diameter of the wind turbine's rotor, which is equal to 85 m) from other RES facilities of the same technology, in order to safeguard the functionality and performance of wind parks. Therefore, at this stage of the present study, there is a recommended buffer zone at 215 m around any existing operational wind facilities, and obviously those located within the areas that were deemed suitable for siting wind farms in the previous stage.

Table 1 Exclusion Criteria Restrictions.

Main categories	A/A	Exclusion Criteria	Buffer zones SFSPSD-RES (d = 85 m)	Buffer zones Literature review (mode value)	Buffer zones Present study
Areas of environmental interest	1	Sites of Community Importance (SCIs)	–	1000 m (Baban 2001; Aydin et al. 2010; Effat 2014; Wang et al. 2014; Latinopoulos and Kechagia 2015; Watson and Hudson 2015)	1000 m
	2	Special Protection Areas (SPAs)	–	1000 m (Baban 2001; Aydin et al. 2010; Effat 2014; Wang et al. 2014; Latinopoulos and Kechagia 2015; Watson and Hudson 2015)	1000 m
	3	Wildlife Refuges	–	1000 m (Baban 2001; Aydin et al. 2010; Effat 2014; Wang et al. 2014; Latinopoulos and Kechagia 2015; Watson and Hudson 2015)	1000 m
	4	Areas of Outstanding Natural Beauty (AONBs)	–	1000 m (Baban 2001; Aydin et al. 2010; Effat 2014; Wang et al. 2014; Latinopoulos and Kechagia 2015; Watson and Hudson 2015)	1000 m
	5	Bathing areas	1500 m	–	1500 m
	6	Coastline	–	2000 m (Effat 2014)	2000 m
Water Bodies	7	Rivers	–	400 m (Baban and Parry 2001; Nguyen 2007; Tegou et al. 2007; Aydin et al. 2010; Zhou et al. 2012)	400 m
Areas of Cultural Interest	8	Archaeological monuments and historical places of high importance	3000 m	3000 m (Xydis 2013; Tsoutsos et al. 2015)	3000 m
	9	Cultural monuments and historical sites	7 d (600 m)	1000 m (Baban and Parry 2001; Tegou et al. 2007; Effat 2014)	1000 m
	10	Monasteries	500 m	500 m (Hansen 2005; Tegou et al. 2010; Tsoutsos et al. 2015)	500 m
Residential Areas	11	Settlements > 2000 population	1000 m	1000 m (Ouammi et al. 2012; Gass et al. 2013; Tsoutsos et al. 2015)	1000 m
	12	Settlements < 2000 population	500 m	500 m (Tegou et al. 2010; Phuangpornpitak and Tia 2011; Zhou et al. 2012; Tsoutsos et al. 2015; Noorollahi et al. 2016)	500 m
	13	Traditional Settlements	1500 m	1500 m (Tegou et al. 2010; Xydis 2013; Tsoutsos et al. 2015; Latinopoulos and Kechagia 2015)	1500 m
Infrastructure	14	Roads	1.5 d (130 m)	500 m (Bennui et al. 2007; Effat 2014; Kazim et al. 2015; Noorollahi et al. 2015)	130 m
	15	Electricity Grid	1.5 d (130 m)	250 m (Effat 2014; Kazim et al. 2015; Noorollahi et al. 2015)	130 m
	16	Antennae/Radar	–	600 m (Lejeune and Kazim 2015)	600 m
	17	Airports	–	2500 m (Voivontas et al. 1998; Nguyen 2007; Aydin et al. 2010; Ouammi 2012; Wang et al. 2014; Noorollahi 2016)	2500 m
Land Use – Land Cover	18	Tourism-related facilities	1000 m	1000 m (Bennui et al. 2007; Xydis 2013; Tsoutsos et al. 2015; Latinopoulos and Kechagia 2015)	1000 m
	19	High-productivity farmland	1.5 d (130 m)	–	130 m
	20	Quarries and Mines	500 m	500 m (Xydis 2013; Tsoutsos et al. 2015)	500 m
Wind Velocity	21	Wind Velocity	–	6 m/s (Voivontas et al. 1998; Wang et al. 2014; Höfer et al. 2016)	6 m/s

Stage 1 / Step 4: Carrying capacity restrictions

Next, and after excluding the areas with an existing RES infrastructure and areas neighbouring on operational wind facilities, and in order to complete the exclusion process, we excluded areas that are too small. More specifically, in the framework of this paper, since the exclusion of the above areas takes place in an ArcMap environment, it is possible that polygonal shapes may occur, which may full fill all the set criteria, but are nevertheless too small, which means that installing wind turbines on this land is either impossible or economically non-viable. For this reason, this paper excludes areas that are less than 300,000 m^2 or 0.3 km^2 in size.

Stage 2: Evaluation criteria

The exclusion criteria, the selection of which is described above, primarily aim at protecting the environmental and cultural background of the area studied and to strictly uphold the safety distances set by the current legislation. It is therefore deemed necessary that the evaluation criteria used in the process of defining suitable areas for the siting of wind parks aim at ensuring that the

project is cost effective, construction costs are minimized and the project meets with the least possible reaction from the people of Andros. For this purpose, five evaluation criteria were selected, which include: EVC1: Wind Velocity (WV), EVC2: Slope (SL), EVC3: Distance from Road Network (DRN), EVC4: Distance from Electricity Grid (DEG) and EVC5: Social Acceptability (SA). Taking into consideration the fact that the construction of a large number of wind parks was suspended on Andros due to reactions from the local community, it was deemed essential to include the last of the above criteria in the present study. For this purpose, a questionnaire was addressed to expert engineers, who either live on or come from Andros, asking them to give a rating to the eight potential areas, resulting from the previous stage of the study (Stage 1). Their rating involved the level of social acceptance they believed would be given for the installation of a wind park in each of these eight areas. In addition, the feelings of the local communities were also included in the evaluation, as recorded by the daily local press.

All the evaluation criteria are presented in Table 2 and described in detail below.

Results and Discussion

In the following sub-section, the results of the present study are presented and discussed. Initially, unsuitable sites for the deployment of onshore windfarms are presented along with the potential/eligible areas, which are candidates for further evaluation (Stage I of the proposed framework, Fig. 1). Next, the results of the AHP application (Stage II of the proposed framework, Fig. 1) are shown and the most adequate areas for the siting of onshore windfarms on Andros Island are determined.

Exclusion of unsuitable areas

Areas that were excluded due to incompatibility, include ports, the heliport, bathing areas, listed cultural monuments, monasteries, telecommunication antennae, road network and electricity grid, SCIs and SPAs of the Natura 2000 network, Wildlife Refuges, AONBs, settlements and highly productive farmland. The excluded areas (Step 1 – Stage 1) are presented in Fig. 2.

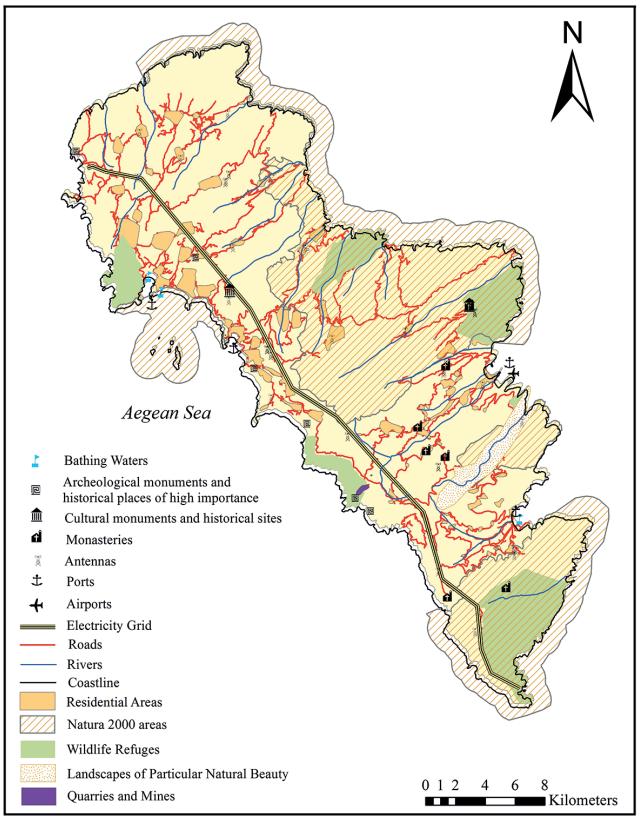

Fig. 2 Excluded areas.

Definition of eligible areas

Next, the minimum distances presented in Table 1 are applied, which in Step 2 – Stage 1 results in the following available areas (Fig. 3).

Step 3 – Stage 1 of the methodology, involves the exclusion of parts of the available areas where RES facilities are already in place. Finally, in Step 4 – Stage 1, polygonal areas smaller than 0.3 km^2 are excluded.

The set of eligible areas that are candidates for siting wind farms and further evaluation are presented in Fig. 4, while Table 3 includes their surface area.

Table 2 Evaluation Criteria.

Criteria	Type	Description
EVC1: Wind Velocity (WV) (m/s)	Economic/Technical	The greater the wind velocity in an area the more electricity will be produced in that area
EVC2: Slope (SL) (%)	Technical/Economic	The greater the slope of an area the higher the construction costs in that area
EVC3: Distance from Road Network (DRN) (m)	Economic	The greater the distance of an area from the road network the higher the construction and installation costs
EVC4: Distance from Electricity Grid (DEG) (m)	Economic	The greater the distance of an area from the EG network the higher the construction and production costs
EVC5: Social Acceptability (SA)	Social	The higher the level of acceptance in an area the easier it will be to construct an RES without a social reaction

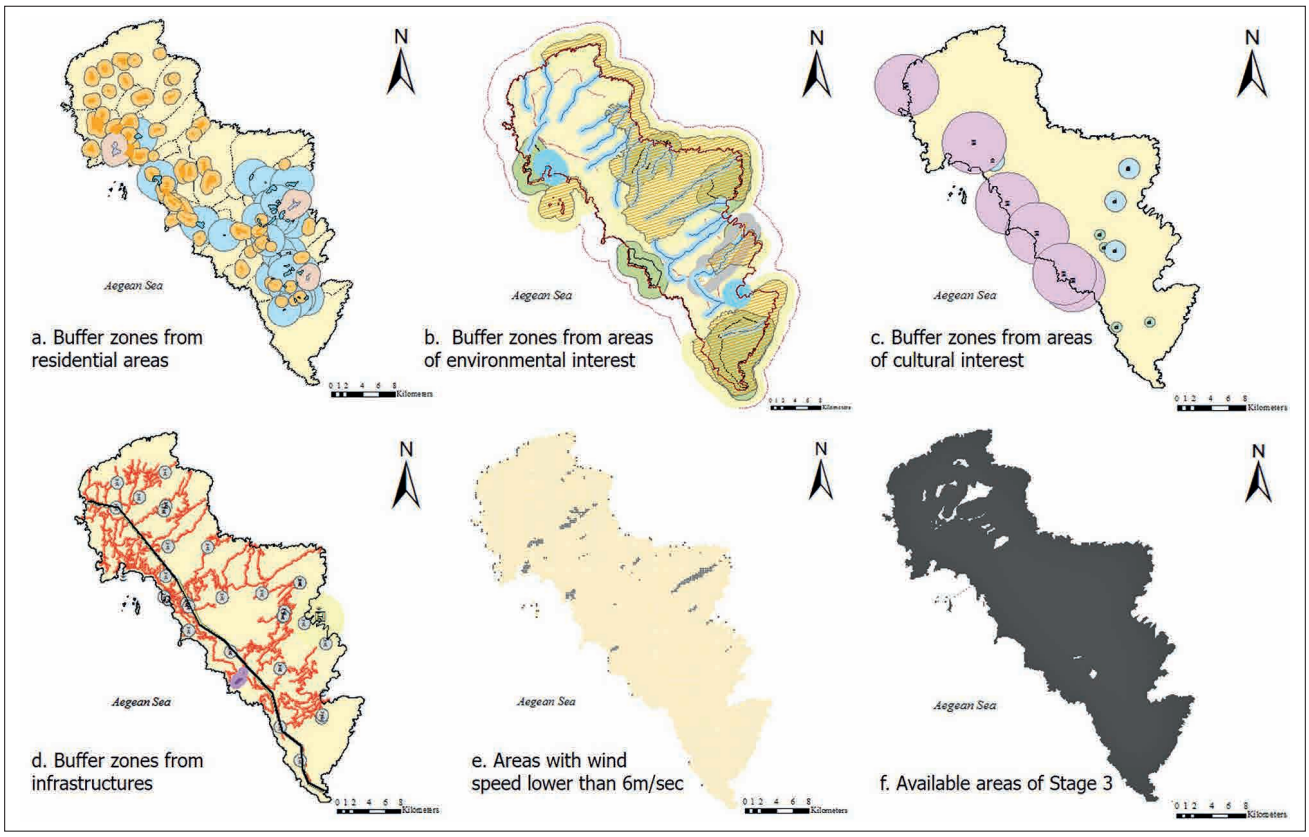

Fig. 3 (a) Buffer zones around areas of environmental interest, (b) areas of cultural interest, (c) residential areas, (d) infrastructures, (e) areas with a wind velocity lower than 6 m/s and (f) suitable areas of land.

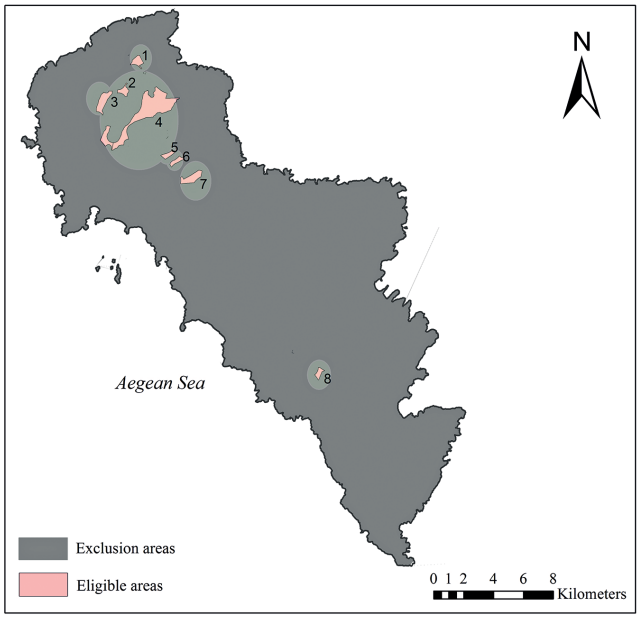

Fig. 4 Candidates areas for the siting of wind farms – areas for evaluation.

Table 3 Surface of eligible areas.

Area	Size (km²)
1	0.556112
2	0.453393
3	1.072405
4	6.718209
5	0.35339
6	0.355856
7	0.964385
8	0.337122
Total	**10.208**

Evaluation and hierarchical ranking of eligible areas

Quantification of the relative weights of evaluation criteria

In Table 4, the pairwise comparison of the evaluation criteria is presented, as formulated by the expert group (authors and experts) within the framework of a more objective rating of the evaluation criteria.

Table 4 Pairwise comparison matrix of evaluation criteria Ci, i = 1–5 with respect to the objectives.

	EVC1 (WV)	EVC2 (SL)	EVC3 (DRN)	EVC4 (DEG)	EVC5 (SA)
EVC1 (WV)	1	3	3	3	1/5
EVC2 (SL)	1/3	1	1	1	1/7
EVC3 (DRN)	1/3	1	1	1	1/7
EVC4 (DEG)	1/3	1	1	1	1/7
EVC5 (SA)	5	7	7	7	1

From the above matrix and the pairwise comparison, it is clear that wind velocity is slightly more important (3) than the slope, the distance from the road network and from the electricity grid, but less important (1/5) than social acceptance. Furthermore, the slope is judged as equally important to the distance from the road network and the electricity grid, but slightly less important than wind velocity (1/3) and far less important than social acceptance (1/7). The rest of the criteria have exactly the same relation to the distance from the road network and the electricity grid. Finally, social acceptance is viewed as much more important (5) than wind velocity and far more important than the other three criteria.

The priority of each criterion is presented in Fig. 5.

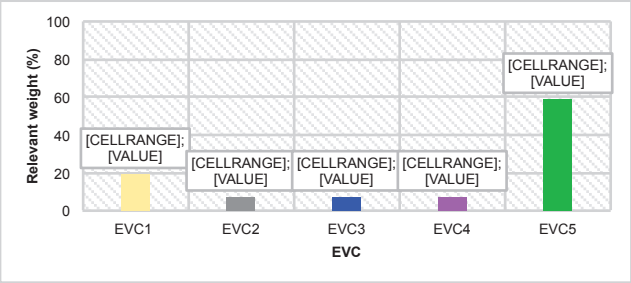

Fig. 5 Relevant weights of evaluation criteria Ci, i = 1–5 with respect to the objective.

The judgments are consistent since CR is equal to 0.01, which is lower than the threshold of 0.1.

Evaluation and ranking of eligible areas

Next, and following the pairwise comparison of the criteria and calculation of their priorities, the pairwise comparison of the elements at the second level follows (Fig. 1), i.e. of the available areas compared to the elements of the first level, namely the criteria. Thus, the eight (8) areas available for siting a wind park are compared with one another, as regards the five (5) evaluation criteria, i.e. wind velocity, slope, distance from road network, distance from electricity grid and social acceptance.

It should be noted that the judgments related to the five pairwise comparison matrices are characterized by adequate accuracy, since the pairwise comparisons have been performed either by using the GIS thematic maps, which are related to the evaluation criteria EVC1 ~ EVC4 or by considering the expertise of locals (EVC5). One engineer and one planner who lives on the island were interviewed and asked to evaluate each site in terms of social acceptability. In addition, the calculation of CR values below 0.1 for all matrices enhances their consistency. The relevant weights of the five priority vectors are shown in Fig. 6.

As can be seen for area A8, which is located in the southern part of the island and comes first for wind velocity, followed by the other areas with much lower scores. The lowest score corresponds to area A6, for which the wind velocities recorded in its interior are lower.

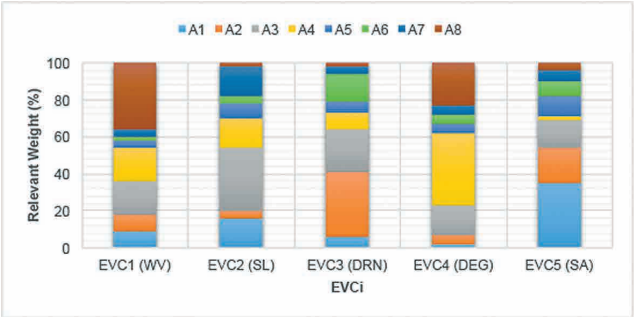

Fig. 6 Relevant weights of decision alternatives Am, m = 1,…,8 with respect to EVCi, i = 1–5.

In terms of the slope, area A3, which is located in the northern part of the island, is top in the ranking, followed at a great distance by the other areas. Areas A6, A2 and A8 are the lowest in the ranking, since their slopes at some points reach 20–25%.

In terms of the distance from the road network, areas A7 and A8 are last, since they do not have access to any part of the island's road network, although they are located very close to various roads. Area A2 is top in the ranking.

Area A4, which is the westernmost of all available areas, and is closest to the electricity grid, comes top in the ranking; then, depending on how far to the east the available areas lie, the lower they are ranked, since the electricity grid extends over the western part of Andros.

Area A1, in the north of the island, is considered to be the one with the highest level of social acceptance, while A4 ranks last.

Conclusions

The present study is an integrated proposal for the siting of onshore wind parks that can be used both in Greece and worldwide. It is applied to the island of Andros that is in the South Aegean, which is a windy area based on Geographic Information Systems (GIS) depicting the data from a Multicriteria Analysis for the evaluation of the suitability of relevant areas.

The extensive literature review and thorough research into the Greek institutional framework, which comprises the Special Framework of Spatial Planning and Sustainable Development for Renewable Energy Sources, have been used to formulate the exclusion and evaluation criteria, which were included in this study. The basic objective for the selection of the criteria is the correct siting of a wind park in order to limit and avoid any effect that such actions may cause on a small island such as Andros, where a limited social acceptance of similar projects has occurred.

The application of the criteria is realized using the methodology proposed in this paper and consists of distinct stages. One stage prior to the evaluation is the exclusion of incompatible siting areas, on the basis of particu-

larly strict criteria, mainly spatially related, which aim to uphold safety considerations, environmental protection and the specifications of the Greek institutional framework. In order to evaluate those areas deemed suitable, criteria are selected that aim to reduce the construction and maintenance costs of the wind farms, and increase the acceptance of the project by the local community and its economic efficiency. It is therefore considered important to include the criterion of social acceptance in this study, which is evaluated using the opinion of expert engineers and reports of the opinion of the local society of Andros in the daily press.

The results of the application of this methodology for Andros are of particular interest, since the areas that emerge as being suitable for the siting of wind parks are primarily located in the northern part of the island, where the largest concentration of proposals for wind plants are located. The areas with the highest scores, that are most suitable, are those adjacent to an existing wind plant. This knowledge could be used as the subject for a debate and of further research into their future unification, so that larger amounts of energy could potentially be produced that would ensure the energy autonomy of the island of Andros.

The present study helps promote the vision of a sustainable energy production, which makes use of the comparative advantages of certain areas, while also supporting the energy policies recommended by the European Union, which aim at sustainability. The recommended methodology is applicable to other islands where the geographical restrictions and exclusion criteria are similar due to spatial characteristics. Furthermore, the stages in the methodological framework can be applied by either readjusting or maintaining the said exclusion and evaluation criteria for any study area or any planning scale (local, regional, national level) depending on data availability and policy priorities.

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A METHODOLOGICAL APPROACH FOR HOLISTIC ENERGY PLANNING USING THE LIVING LAB CONCEPT: THE CASE OF THE PREFECTURE OF KARDITSA

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ABSTRACT

The development of urban and rural landscapes has entered a pioneering era with novel combinations of energy production and consumption and related changes in the urban and rural fabric including associated socioeconomic issues. Accompanying this change is a realization that newly developing energy initiatives are more viable for development and upscaling and are less vulnerable to failure and resistance from society if they are well integrated into their local and regional contexts. However, institutional questions remain regarding the required mechanisms and levels of integration, while simultaneously sustainable energy planning requires that the stakeholders with diverse and conflicting objectives come to some degree of consensus. Inspired by these findings, a methodological approach for holistic energy planning on a regional/local level was developed within the framework of the INTENSSS-PA project that is funded by HORIZON 2020. The approach provides a holistic energy plan, which goes beyond a blueprint for allocating renewable technologies and is based on the involvement of the wider community. Hence, this approach includes aspects such as the development of spatial concepts, new co-creating strategies, business cases, societal alliances and institutional changes and formats. To implement this approach, the Living Lab (LL) concept is applied. The case of Karditsa, in Greece, will be presented as evidence of the effectiveness of the proposed planning approach.

Keywords: integrated sustainable energy planning; participatory decision making; regional development; regional living labs; spatial planning

Introduction

Integrated energy planning implies the integration of the energy theme within spatial planning in order to accommodate the integration of energy systems within their physical and socioeconomic landscapes (De Boer and Zuidema 2015). Specifically, integrated energy planning assumes that linking alternative land use functions and the interests associated with them has benefits for exploiting the potential of different renewable energy sources. After all, such linking can accommodate sustainable energy alongside and in direct synergy with alternative societal interests and developments such as agriculture, nature maintenance, mobility or economic development. In doing so, social engagement and participation are required to avoid Not in My Back Yard (NIMBY) and Not in My Front Yard (NIMFY) and allow local self-organization for the development of Yes in My Back and Front Yard (YIMFBY) projects (Owens 1990; Kontogianni et al. 2014).

Integrated energy planning provides a means of identifying and understanding area-based conditions that may enable or accommodate energy initiatives and how these initiatives can be supported by the local society and connected to the local economy. Nevertheless, integrated energy planning is not merely a matter of spatial design but also of institutional design as it involves several stakeholders with diverse and sometime conflicting objectives that must come to some degree of consensus. As coping with energy is relatively novel within the realm of spatial planning, there is a current lack of institutional frameworks to support their integration (e.g. De Boer and Zuidema 2016). Hence, creating effective energy-related planning processes presupposes deep changes in the structure and organization of society (Sørensen and Torfing 2007; Crawford and French 2008; De Boer and Zuidema 2015). Notably, local and regional governments are forced to find solutions in a dynamic and changing field where alternative societal partners interact with other stakeholders. Various initiatives have been carried

out to facilitate the more active and systematic participation of stakeholders in integrated energy planning. Such indicative examples are the Country Governance Committees and the Energy Virtuous Living Labs within the framework of the RES H-C SPREAD (2014–2016) and EnergyViLLab projects (2011–2014).

Fig. 1 provides a schematic representation of how integrated energy planning can be represented. It is based on the assumption that the governing of changes in energy systems involves a multi-level and multiple-stakeholder group process of shared governance (e.g. Loorbach 2010). Connecting energy and spatial planning is therefore also a process of connecting various spatial levels and levels of authority. In the meantime, it is a necessary to include various stakeholders in multidisciplinary fields in the development of feasible, viable and bankable energy projects. While these characteristics already contribute to the challenging nature of integration between energy and spatial planning, continuously increasing planning requirements imposed by the European Union and in many regions a relatively stagnant economic environment places governments in a position where social and market participation is not only desirable, but crucial. Hence, an attempt was made to develop an approach not only to guide Public Authorities but also to carry out a form of experiential learning that will lead to an innovative and acceptable institutional decision-making process involving societal and business partners and cross-departmental agendas.

The objective of this paper is twofold: firstly, to present a holistic methodological approach for integrated sustainable energy planning at regional/local level and, secondly, to present the results of using this approach in the Prefecture of Karditsa in Thessaly, Greece.

INTENSSS-PA Project Framework

A Systematic Approach for Inspiring Training Energy-Spatial Socioeconomic Sustainability to Public Authorities – INTENSSS-PA project is funded under the 2015 call of the HORIZON 2020 program. The objective of INTENSSS-PA is to develop and implement a human and institutional capacity building process related to sustainable energy planning and energy projects implementation addressed to public authorities and societal stakeholders to support them in entering a new era of integrated sustainable energy planning through a participatory, multi-level, interdisciplinary decision-making process. A multidisciplinary team of 17 partners from public and private sectors and academia coming from 7 Member States constitute the project's consortium.

To achieve the above-stated objective, INTENSSS-PA considers a four-step approach:

- to build a planning approach-structure including supportive materials and tools for its implementation;
- to build a human (i.e. technical) and institutional (i.e. mainly normative and cognitive) capacity;
- to build proof of concept through experimentation into the different planning contexts and energy-related issues considered in the participating countries;
- to build institutions to explore alternative frameworks, that will ensure the operation of the identified planning concept-structure beyond the project duration.

To implement this approach, the Living Lab (LL) concept (Dutilleul et al. 2010; Ståhlbrost and Holst 2012; Ballon and Schuurman 2015) was adopted. An LL is "a user-centric" research methodology for sensing, prototyping, validating and refining complex solutions in

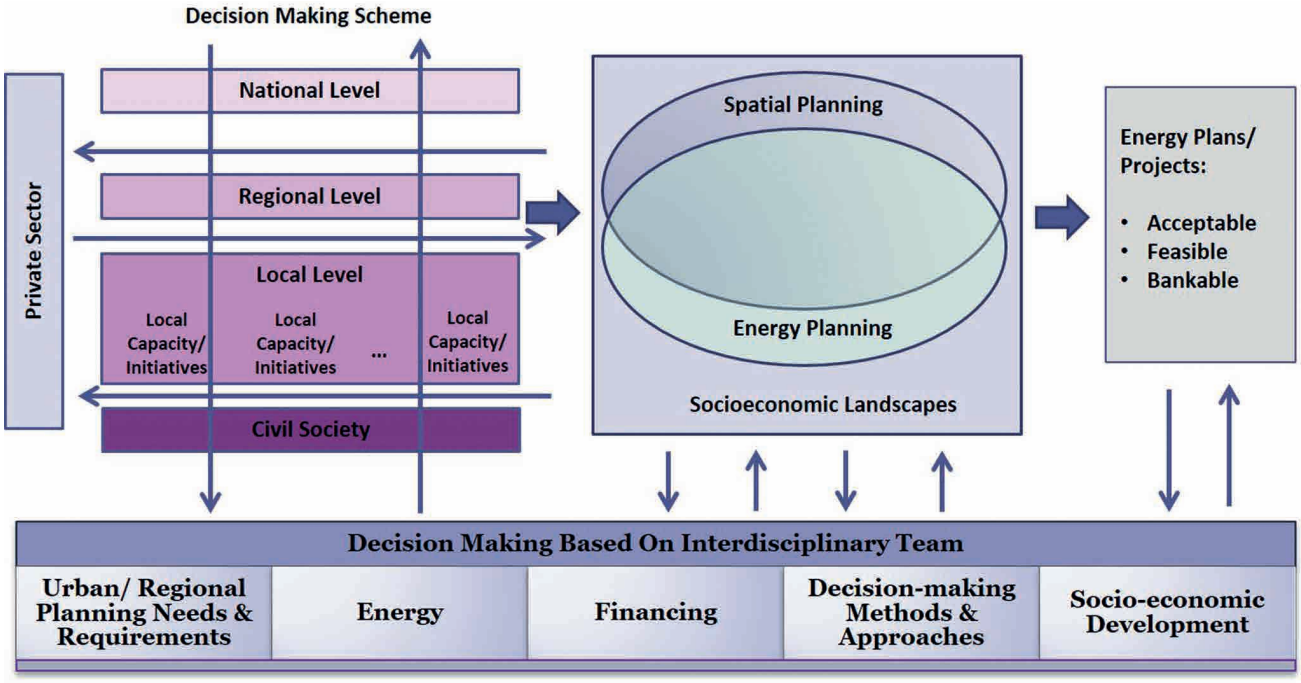

Fig. 1 INTENSSS-PA Concept.

multiple and evolving real life contexts. LLs are defined as both an environment and an approach, supporting innovation processes for all the stakeholders within a real-world context rather than a constructed laboratory or project default setting.

Following its application in other regional or urban governance contexts (e.g. Nevens at al. 2013), the LL concept was identified as a promising inspiration for supporting the INTENSSS-PA approach. The LL-approach, both appreciates the experimental nature of developing and implementing integrated energy plans and the fragmented multi-actor environment in which this development needs to take place. In a way, LLs allow for both the development and experimentation with innovative integrated energy planning concepts and, while doing so, help to create the institutional, technical and economic capacities needed for implementation. That is, the LL concept is both an environment for experiential learning and an institutional framework that might support the process of decision-making and institutional development. In response, the INTENSSS-PA LLs (i.e. Regional Living Labs–RLL) are defined as emerging citizens-public-private partnerships in which all stakeholders work together to create, experiment and evaluate innovative approaches and institutional innovation related to integrated sustainable energy planning.

To combine integrated energy planning and the LL-approach a 'Holistic Energy Planning Environment' was created for INTENSSS-PA to develop, evaluate and exploit, as presented in Fig. 2. The RLL environment involves the provision of structured expert support with the involvement of: (i) a technical facilitator within each RLL, (ii) an interdisciplinary group of experts to develop methodological tools and guidelines, and (iii) a Database of Practice that includes training materials and case-studies to support and inspire the RLLs. This environment safeguards and enables the operation of the newly established RLLs as well as facilitating their operation. The approach aims to develop the conditions of a transnational thematic network of RLLs as well as the conditions to assess the capacity of the RLL concept to support and be incorporated in the institutional framework of energy planning of different Member States/Regions (INTENSSS-PA (A) 2017). RLLs are then expected to add value to integrated energy planning by developing and testing planning processes and strategies in relation to a more open and collaborative approach to governance, while making the role of involved stakeholders more effective and the decisions more legitimate.

Methodological Approach

The fulfillment of the established objectives is pursued through the constitution of the INTENSSS-PA RLL network, which is fueled by a common repository of methods, tools and the experience of all stakeholders (ALCOTRA 2013). A methodological approach was developed within the INTENSSS-PA project for the formation of the RLLs, for handling the challenges of integrated energy planning the RLLs were to face, and for creating a process and structure of governance that would effectively promote

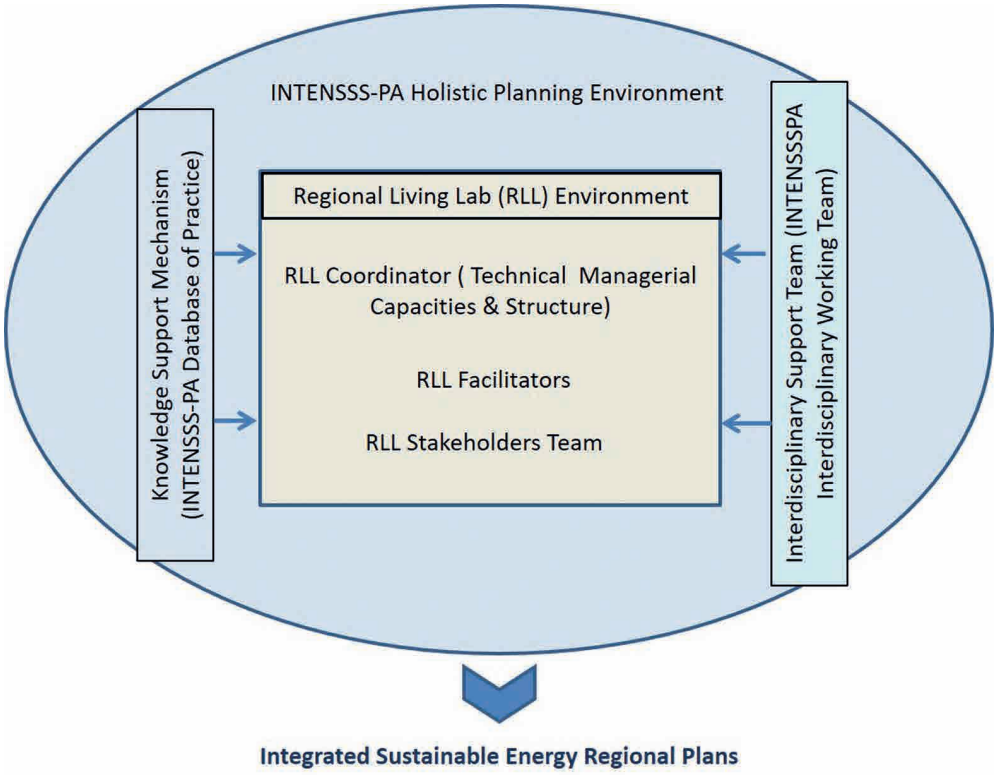

Fig. 2 INTENSSS-PA Implementation Environment.

reliant interest and address the converging requirements of the involved stakeholders (Ståhlbrost and Holst 2012; ALCOTRA 2013; INTENSSS-PA (A) 2017).

The overall methodological approach for establishing and operating RLLs in Holistic Energy Planning includes four iterative steps that are presented in Fig. 3 (Ståhlbrost and Holst 2012). The first procedural step provides a structured path for the creation of an RLL. This step involves the analysis of the contextual factors of the spatial and energy planning process in each region, the identification of the related stakeholders and their role, the socio-economic settings, institutional structures and the spatial and energy capacity of each region. The second step focuses on the co-decision of the *planning focus* of each RLL. In particular, within this step the focus, the vision and the scope of the plan is decided upon, including specifying the involvement of the stakeholders throughout the process of planning, decision making and implementation. The third step is the actual process of planning, which is specifically based on stakeholder involvement. As such, it is based on notions of co-design and co-creation (e.g. Bergvall-Kareborn et al. 2009; Evans and Karvonen 2011; Leminen 2015). Described as a process of *co-planning*, it is during this step that the holistic energy plan is developed and that actual Experiential Learning Activities take place. Finally, the fourth step is focused on the *overall assessment* of the Integrated Sustainable Energy Plan -ISEP developed, as well as the efficiency and effectiveness each time of the co-planning process.

Within the context of INTENSSS-PA, the notions of co-creation and co-design are used as interchangeable terms. Co-creation and co-design are concepts for the interactions between public, private and civic sectors (Sleeswijk Visser et al. 2005; Sanders and Stappers 2008). Co-creation acknowledges that these three sectors are interdependent: that means that all three sectors are necessary to develop and implement policies and measures. Therefore, in co-design processes these three sectors should always collaborate. A co-design process should bring together professionals/practitioners, governmental organizations, "ordinary" citizens and market representatives (network companies, SMEs, etc.) to make better use of each other's assets to achieve better outcomes and/or improve the efficiency of the process.

Within each of these four steps, work is organized and implemented focusing on the five key principles of an LL approach, i.e.: value, influence, sustainability, openness and realism (Ståhlbrost and Bergvall-Kareborn 2008; Ståhlbrost 2012). To achieve these principles, the RLL activities should allow stakeholders to develop holistic energy planning in their context, to determine if it brings *value* to them and provide insights about how they perceive value. Moreover, the established decision-making process must go beyond participation, involvement or engagement of stakeholders by providing them with the opportunity to *influence* the innovation. In this respect, it is important to make sure that the needs and ideas of domain experts and stakeholders are clearly traceable in the holistic energy planning environment and approach, and to ensure that the participation, influence and responsibility among stakeholders are balanced and harmonized. In other words, the processes of co-creation and co-planning go hand in hand with ensuring that the key principles to which an LL approach should adhere, are met. Within the realm of an LL, sustainability is less about environmental sustainability and more about the development of institutional relationships for the present and the

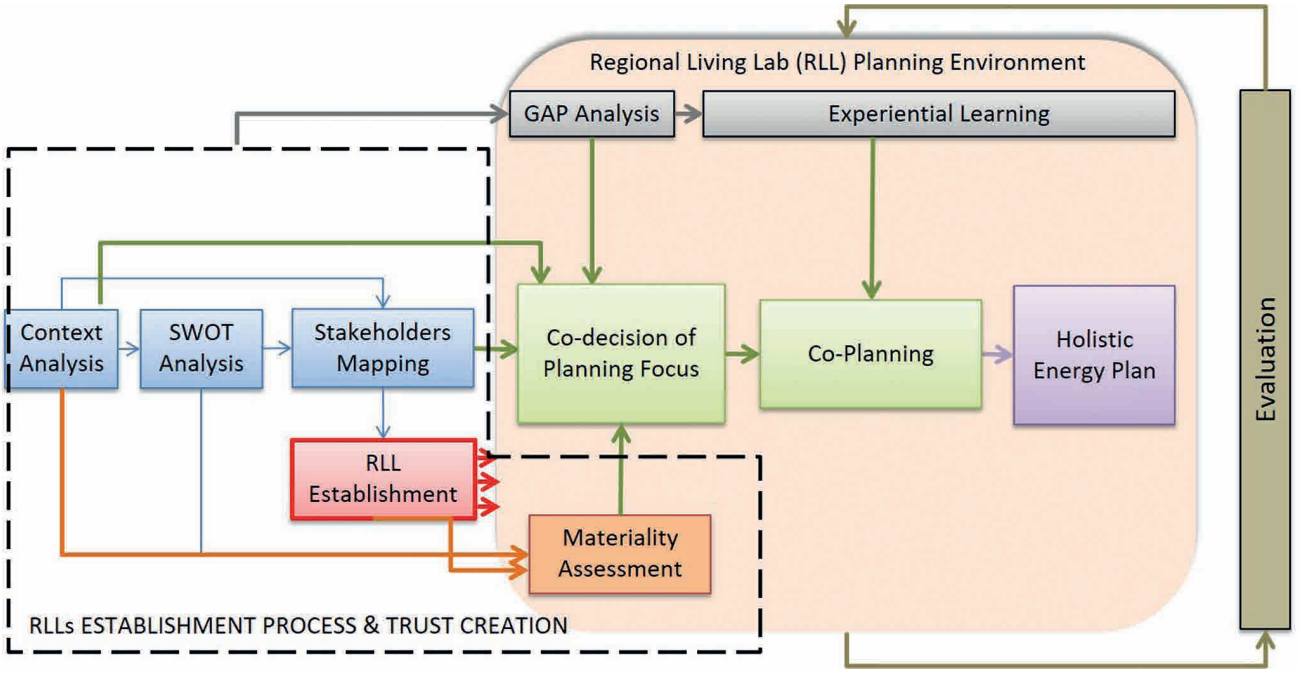

Fig. 3 INTENSSS-PA Implementation Methodological Approach.

future. Trust, collective ownership and continuous learning are then the driving forces for policy development and implementation. In such a context, *openness* seems to be a requirement for sustainable relationships and collaboration among people of different backgrounds, perspective, knowledge and experience to secure faster and feasible integrated sustainable energy planning. Finally, *realism* is a cornerstone of an LL-approach since innovation should be carried out in a realistic, natural, real-life setting. Since all stakeholders have their individual local reality, everyone has a potentially useful view of how the current situation can be improved (Krogstie and S¢lvberg 1996).

In summary, the proposed Holistic Energy Planning Approach using an RLL environment provides the capacity to experiment and develop new forms of social innovation, which are sustainable and well-balanced regarding representative participation on the side of society and a public-private partnership. Furthermore, it relies on strong networks of stakeholders that can increase and upscale the benefits of LLs about energy-related innovation by ensuring the necessary critical mass for its continuity while considering jointly the effect of a globalized economy and local daily needs.

With co-creation central to INTENSSS-PA a key question early on was how to secure a true participatory process based on co-creation. To accommodate this, the RLLs all followed a similar format that was directly linked to steps 2 and 3 of the general methodology. Following step 1, all RLLs would have gained awareness of the key stakeholders, the relevant (policy and economic) context and the strengths and weaknesses of the region (SWOT). Subsequently, the RLLs were to be established with the first objective of working towards steps 2 (vison and concept development) and 3 (experimenting in practice) being a 'gap-analysis'. The gap analysis was to be conducted by all RLL partners in workshops and through iterative rounds of communication. The gap-analysis allows RLL partners: (a) to identify gaps in their current institutional capacities and ways of working (tools, techniques, and practices) and (b) to identify inspirational examples of useful technical, spatial and institutional practices and tools they might use to fill these gaps or add to their current practices and tools. The gap-analysis was thus instrumental in gaining a deeper understanding of regional challenges by explicitly recognizing what was possible (reference cases) and what was lacking (current institutional capacities). In doing so, it also improved the mutual understanding among stakeholders of defining a common-problem and the kind of skills, tools and resources they would have to use.

Following the gap-analysis, the RLL would move on to steps 2 and 3. A boundary between steps 2 and 3 of the methodological approach, that is, the idea close to original LL studies, where testing with a concrete product is an underlying issue, because it was considered "artificial" by all RLLs. Therefore, the methodological approach was subsequently adjusted (i.e. the LL concept) to achieve a flexible approach for RLLs to implement steps 2 and 3 that would: (a) allow conceptual thinking and plan that development continuously interact and (b) focus specifically on those substantive or institutional gaps identified in their current energy planning. After the gap-analysis, based on a shared understanding of problems and opportunities, the RLL partners can decide where they want to focus (step 2). Such planning contains a substantive focus, as is expressed in, for example, a vision for developing bio-based heat networks, electrifying transport or full-scale regional energy plans. But this planning focus also contains an institutional focus, expressed in the kind of tools and organizational formats relied on and developed, ranging from covenants, regional partnerships or community initiatives. Overall, a planning focus thus sets an agenda for action that is directly inspired by local realities: i.e. it is tailor-made for the identified needs of each regional area.

Step 3 is supported by a framework for plan development (Fig. 4) that explicitly tries to accommodate the desired flexibility for each RLL without losing the core values of INTENSSS-PA: co-creation in an LL environment and integrative working to identify synergies between energy and other regional priorities. Work on setting a planning focus fluently translates into the co-creation in the RLL of a substantive vision suiting the RLL (Phase 1 of step 3). Central to Phase 1 is the development of a vision of the future energy system of a regional area or targeted elements of it, which will be the central reference point and inspirational guidance for both forward and backward mapping. The vision is the substantive (content) driver for the plan, while the plan itself also suggests pathways and actions to pursue this vision. There should be social (civic) and political support for the process of co-creating a vision. The vision initially does not need to be highly specific, but should contain a picture of the long-term future (30 years) of the regional energy system or target parts of it in relation to the physical and socio-economic landscape. It should include general energy goals and identify useful technologies to achieve them, while also identifying land-use functions (e.g. housing areas, villages, agricultural lands) or specific spatial areas in a more general sense, where certain measures and technologies are prioritized. It should also include an expression of how energy goals link with other regional priorities, which include agriculture, nature management, industry, services and offices, mobility and housing. As such, the vision is focused on creating a sustainable energy system or specific targeted parts, while recognizing how this system links with and can support other regional developments. This also implies that the vision should be a meaningful guide for the policy for development in other sectors within which the relevance of the vision is shared.

If the vision is socially and politically endorsed, the next step is to move towards the development of the ac-

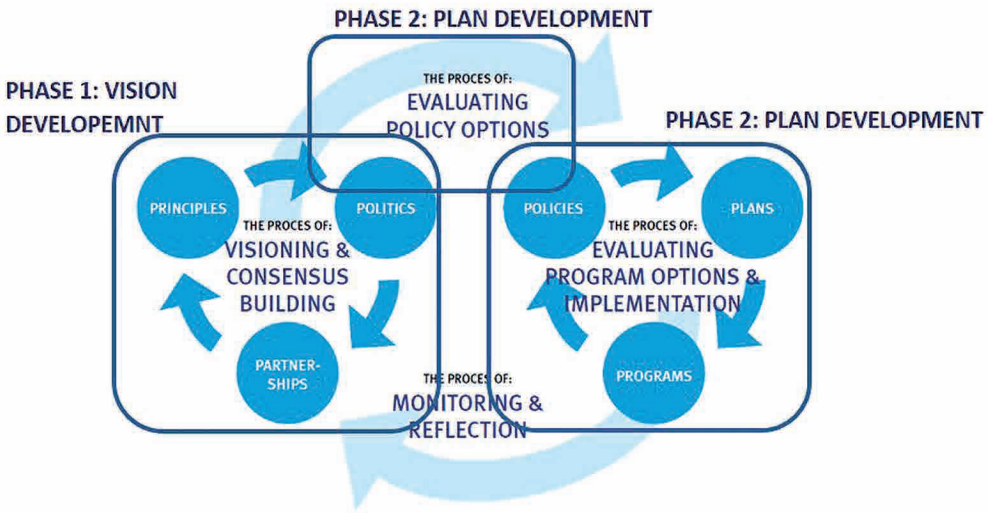

Fig. 4 INTENSSS-PA Sustainable Plan Development (based on Creedy et al. 2007).

tual Plan (i.e. Phase 2 of step 3). Central elements for the phase of Plan Development are:

- the creation of pathways to achieve the vision along with the identification of current potentials and barriers (forward mapping);
- the development of institutional infrastructure to pursue these pathways (backward mapping);
- the identification of the resources needed for the short-, mid- and long-term processes, including human resources and expertise (backward mapping);
- the initial identification of short- and mid-term projects, possible policy choices, plans or programs (combined forward and backward mapping).

The pathways are based on the technologies, investments, regional developments and existing local projects and potentials identified. These pathways are meant to be inspirational and trigger the development or coalitions of possible investors and projects. They are not yet meant to have clear-cut contracts or budgets. Rather, they form a general roadmap to inspire and evaluate alternative projects, plans and policy choices. It is possible to develop one pathway to pursue the vision, while it is also possible to identify different pathways. Shifting between pathways might become necessary if, for example, (inter)national policies change, if ongoing learning shows new technologies or choices are more sensible, if new opportunities for subsidies or investments become available, or if some preferences change. Hence, it is advisable to be able to change if needed. It is nevertheless also advisable to keep the number of pathways limited to ensure a degree of coherency. The overall approach proposed and presented within INTENSSS-PA is considered as an overview of a wider and long-term process of Strategic Sustainable Energy Planning (Steidle et al. 2000; Lund et al. 2013). It specifically targets, on the one hand, the need to focus on seeing energy as integrated with the region's physical and socio-economic landscape and thus requiring a cross-sectoral and participatory approach. While this focus requires the creation of a coherent framework, which is based on co-creation in an RLL approach and in particular on identifying synergies between energy and other regional priorities, it also needs to be flexible. On the other hand, the INTENSSS-PA methodology does not *prescribe* plans. Instead, it merely provides a structure and helps to highlight substantive considerations. Within this process, it is up to each RLL (i.e. regional area) to identify its ambitions; that is whether they are interested in following the entire trajectory for developing a plan, or whether they recognize specific elements in the plan that reflect their current needs. This choice guides their RLL Planning Focus, which can be the development of a vision, an institutional body or covenant, a partnership, a specific planning tool, a roadmap, etc.

The Case of the Karditsa RLL

The RLL of Karditsa is coordinated and hosted by the Development Agency of Karditsa (AN.KA SA), which has a significant role in the energy and spatial planning of the Prefecture. It was established by Local Authorities in 1989 and currently is a "local partnership" that focuses on projects of social interest and environmental protection.

The context analysis and SWOT analysis revealed that currently there are three prevailing positive circumstances that can support and be supported by INTENSSS-PA:

- the existence of a Cooperative Bank and its healthy financial situation that reduces to some extent funding uncertainty,
- the fact that the Energy Cooperative Body of Karditsa (ESEK) seems to perform well, being a success story in the Prefecture in terms of energy cooperative schemes, and
- the existence of a substantial biomass stock (i.e. municipal waste, forest residues, agricultural and farming residues) in the Prefecture owned/produced by local stakeholders.

A positive attitude of the community is expected because the economic crisis has resulted in increased energy costs and unemployment.

Major threats identified are those from the legislative framework in relation to the process of granting permission for energy production facilities and land-use constraints. It is also interesting to mention the lack of know-how and inability for consensus that recognize the threats along with the scarcity of available and accessible capital.

Stakeholder mapping revealed 25 different stakeholder groups in Karditsa involved in or significantly affected by integrated sustainable energy planning. Stakeholders were prioritized and grouped in terms of their importance for the planning and their capacity/power to influence the planning process and plan implementation at a later stage. In addition, an analysis of collaborations, synergies or conflicts among the stakeholders or other community groups has been conducted creating a stakeholder relationship canvas and providing a set of scenarios (INTENSSS-PA (A) 2017).

Based on the above analysis, the constellation of the RLL in the different stages of project development was identified. The main groups of Karditsa RLL participants are as follows:

- Local Authorities: Regional Authority of Karditsa, the six Municipalities of the Prefecture, the Association of Municipalities of Thessaly Region
- Forest Management Service
- Energy Cooperative Body of Karditsa ESEK
- Oikosfaira NGO
- Technical Chamber of Greece (Regional Department of Central and Western Thessaly)
- Chamber of Commerce of Karditsa
- The Technological Institute of Thessaly through the Department for wood and furniture, and the Department of Forestry
- Cluster of businesses – construction sector: ROMVOS
- Sawmill Industry PINDOS FORESTRY
- Cooperative Bank of Karditsa

It must be mentioned that further to these 17 stakeholders there are more groups to be considered during the different planning phases, such as farmers' associations, forest owners and cooperatives, depending on the decision for the Planning Focus and co-planning needs.

Prior to the formal invitation to participate in the RLL assembly and activities, informal meetings were organized in order to inform each stakeholder about the project's concept, and request their support and commitment. During the formal initiation meeting of the RLL in Karditsa in June 2016 the context analysis, the SWOT analysis and the stakeholder mapping were presented, discussed and revised/enhanced in certain cases providing in this way an initial validation process for this analysis. Nevertheless, a number of major energy-related issues for the regional area were identified and discussed based on the implementation of a materiality-assessment process. Twenty-five issues related to regional conditions, people, funding capacity, awareness, land use, legislation and the structure of renewable sources and energy market in Greece were identified. After implementing the materiality assessment, a hierarchical list of the 10 most relevant issues affecting the regional energy planning were identified, which prompted further discussion at a second RLL meeting.

The most relevant issues with highest scores were "Residues and waste from farming, agriculture and forestry (biomass) management", followed by "High costs for equipment conversion from conventional energy to renewable energy" and "Lack of public awareness of actual RES and RET application costs and benefits".

A gap-analysis was carried out with the support of the project team, which provided useful input that was discussed at several meetings of the RLL in order to co-decide on the Planning Focus of the RLL. These meetings were sectoral (i.e. forest sector, agricultural sector, etc.) or held at the request of the main RLL assembly. In the case of Karditsa, the gap-analysis merely confirmed the materiality assessment and the co-decision of the RLL, which was to focus its planning effort on the development of a "Strategic Plan on the energy exploitation of the biomass in the Regional Unit of Karditsa". This strategic plan will attempt to provide the big-energy picture for Karditsa and focus the planning effort on the currently mature socio-economic development of the regional area pathway, i.e. the pathway of biomass (INTENSSS-PA (B) 2017).

The biomass energy exploitation brings together several characteristics, which form a fruitful environment in which to pursue sustainable energy planning and outcome:

- it is participatory in nature since it includes the public and private sectors as well as the citizens (Public-Private-People partnership);
- it is mature and tangible since the local energy cooperative has already constructed a plant, supported by the local authorities and (partially) financed by the Cooperative Bank of Karditsa;
- it is largely feasible since the social opposition to the biomass energy projects is low;
- it has a strong spatial aspect, given that the plan has to indicate the most appropriate placement of the biomass plants, which is a multi-criteria decision-making problem;
- it has a strong socio-economic aspect, given that biomass exploitation could provide financial benefits to many different groups in the local population (farmers, cooperatives, wood industries-traders, municipalities, end-users);
- it has an important environmental benefit, given that biomass collection will reinforce the fire-protection system of the region, preserve natural landscapes and contribute to the replacement of fossil fuels.

Working on a regional basis with the involvement of the national team and the project's interdisciplinary

team, ANKA prepared a preliminary vision for the region, based on the current energy and societal profile, followed by the preparation of alternative development scenarios, including, notably, measures and technologies on biomass exploitation. The energy profile and the alternative scenarios were presented to the RLL's participants during a workshop, where an assessment of alternative scenarios was conducted by means of a questionnaire. Karditsa's RLL is currently in the process of analysing the data collected in order to proceed with the co-development of the plan for the most preferred biomass development scenario.

The focus on the biomass pathway in Karditsa, i.e. the co-planned integrated sustainable energy plan, will be more integrative and less sectoral, which is a novel outcome of the INTENSSS-PA approach. It will be combined with other policies affecting local development and there will be a clear effect on forestry, agriculture (especially of certain crops) and wood-processing, providing opportunities to increase income and decrease energy costs by developing models of circular economy. Positive relations are also foreseen concerning the waste management sector and industry sector.

ANKA initiated a number of meetings with all the technical and economic partners related to the regional area and the project under consideration. Of paramount importance for the plan's acceptability is to identify a compromise solution for the location of the biomass facilities that will ensure the investment's cost-effectiveness with minimum compromises, if any, over the quality of the landscape and life of the inhabitants. An important parameter for Karditsa will be the contribution of the proposed energy projects to the local economy. Meetings and discussions planned for the near future will focus on identifying and selecting alternative implementation approaches, i.e. identify an implementation instrument, liaisons with other planning initiatives and programmes, requirements to be fulfilled, revision and update of the stakeholder groups to be involved, financing aspects, risks, etc.

Since June 2016, the RLL has held five assemblies, four sectoral workshops and several meetings and Skype meetings with local and national stakeholders and the INTENSSS-PA multidisciplinary team. In addition, several articles have been published in the local press and presentations made at local events. More publicity and organized involvement of the society is planned for the remaining co-planning period since citizen participation is of a paramount importance at the co-planning phase.

Concluding Remarks

Integrated energy planning is a necessary approach especially important for regional areas where the need to transform their energy system is currently very obvious. The case of Karditsa clearly proves this need but due to the lack of existing policies and financial instruments a lot of progress needs to be made and prerequisite steps to be taken to realise integrated energy planning. Indicatively, the regulatory framework of biomass exploitation is outdated and complicated. Responding to this gap in the policies and regulations, INTENSSS-PA aims to add value by promoting a process of co-creation set in a LL-environment.

What was learned from the case of Karditsa is that the added value of co-creation in an LL-environment is recognized and appreciated by regional/local partners. The expected added value from the formulated energy plan as an outcome and the RLL as a process will be significant for Karditsa. In particular, the development of an energy plan including tangible proposals and actions will provide strategic guidance, necessary to face the planning requirements stemming from the national law and/or to take advantage of future funding opportunities for energy projects. The most important challenge for Karditsa's RLL is to ensure its continuity. The core team of stakeholders is currently committed to the project, whereas some key-stakeholders have to be encouraged to take part more intensively. Over the past few months, there has been a moderate decrease in the willingness of some stakeholders to participate in RLL activities. This fact is linked to: a) the lack of familiarity with long-term planning approaches and collaborative practices, b) the sense that such decisions fall into the competencies of national authorities and c) practical barriers (e.g. differences in the working hours of the participants).

On open-ended questions, stakeholders acknowledge that the RLL provides a "sense of shared responsibility", it supports "a more active approach" and "fosters stakeholders' willingness to provide new ideas and solutions for particular issues". Public authorities and different departments understand and realize "the power of their mutual collaboration" and the RLL's contribution "to the reinforcement of mutual trust". Hence, the Karditsa RLL is now recognizing that effort should be devoted to identify an appropriate institutional structure for the RLL. This is to facilitate participatory co-planning and multi-level governance that will provide the RLL with the power to endorse developed energy plans and projects or to coordinate and offer public bodies the power to endorse these plans and projects.

Karditsa also confirms a common outcome from the preliminary internal assessment of the perceived effectiveness of the seven INTENSSS-PA RLLs in performing Integrated Sustainable Energy Planning conducted in October 2017. It revealed that the impression of almost all RLLs' coordinators on the perception of the participants of the RLL concept is that it is quite meaningful. However, it also shows that only those RLLs that unite a group of committed and knowledgeable partners seem to make a difference in developing and implementing visions and plans.

Despite the premature stage of INTENSSS-PA RLLs, it is apparent that RLLs both as an approach and an environment provide a meaningful and fruitful concept for regional development and energy transition where different sectors and levels of governance cooperate in the search for a commonly agreed vision and objectives. The involvement of multilevel governance structures is essential for the successful implementation of integrated sustainable energy planning. Such an approach accommodates the creation of trust in relation to scope and continuity as well as providing a good balance of top-down and bottom-up approaches.

Acknowledgments

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MODELING URBAN DYNAMICS: THE CASE OF PERIURBAN DEVELOPMENT IN EAST THESSALONIKI

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ABSTRACT

Understanding cities and their development is a complex and multifaceted issue. Cities are places where individuals, households, companies etc. concentrate to benefit from the agglomeration and proximity of urban activities. There are many ways to approach the critical question of how urban activities are spatially organized and interrelated to produce space and create cities. Recently a great number of complex systems were developed as part of the complexity theory approach in order to study urban dynamics, while mathematical models are seen as a new opportunity to explore the spatial relations via new evolutionary approaches.
Taking into consideration that the world is complex and no model can incorporate all the possible factors that cause urban growth we focus on the dynamics of land use and transportaiton infrastructure using a simple urban model for the periurban area of east Thessaloniki. Given the fact that there are no records of such models being used in studies of Greek cities over the last 25 years, makes this an important contribution to the use of models in a greek setting. Therefore, an applicability assessment of the model for the three different modelling steps (data acquisition, calibration and forecasting) is conducted. The application of the model indicates that despite issues about the availability of data, the calibration and forecasting results are promising for the use of urban models in greek cities. Furthermore it highlights the significance of using quantitative methods for understanding cities as systems, which in turn will enable us to make better planning decisions about our cities in the future.

Keywords: complexity; land use models; Thessaloniki; urban dynamics

Introduction

Understanding cities and their development is a complex and multifaceted issue. Cities are places where individuals, households, companies etc., concentrate to benefit from the agglomeration and proximity of urban activities. From a systemic point of view urban activities are organized at different scales (neighborhood, city, metropolitan etc.) and are interrelated in various aspects.

There are many ways to approach the critical question of how urban activities are organized and interrelated to create cities and their spatial configuration. The answer is neither simple nor obvious. Some try to explain cities' spatial configuration using principles like the continuation of historical development and land quality (i.e. suitability and attractiveness) while others explore public policies and the interactions of the interdependent components of the city (Schrojenstein et al. 2011). No matter the approach used to understand the evolution of urban systems the practical implication is that it is important to measure and understand the drivers of urban growth across the entire social system (Balmaceda et al. 2017). Therefore, urban planning must be informed of the state of art of our scientific knowledge through a highly and substantially interdisciplinary approach.

Recently many complex systems have been developed as part of the complexity theory approach used to study urban dynamics. Proponents of complexity theory and the evolutionary approach argue that spatial planning should reinvent itself to serve the new challenges of an urbanized world, and of which new techniques of data collection, mining, management and pattern recognition should be a part (Batty 2012).

In the context of this new paradigm for city science, there is a quest for complex systems. According to Boccara essential properties of such systems include a large number of components interacting via simple rules that are not centrally cotrolled, as in a self organized system (Boccara 2010). Furthermore, the conversation of the characteristcs of complex systems and the mathematical models that portray them, evolves around the concept of non linearity and the multiplicity of states that a system can achieve. Allong these lines Geoffrey West, coordinator of big projects on the new science of cities, thinks that collecting and analyzing big data sets could help us discover the laws of evolution of urban phenomena (TED Global Talk 2011). He also emphasizes the fact that the use of advanced mathematics to understand cities does not necessarily contradict the view of cities as a set of complex semi-autonomous and interdependent components and processes. Therefore, mathematical models should be seen as a new opportunity to explore spatial relations that include new evolutionary approaches that depend on the availability of massive data sets, in most cases real data that reflects human behaviour (Batty 2012).

In terms of the discourse on the new science of cities, this paper focuses on the use of mathematical models to depict urban dynamics. Taking into consideration that the world is complex and no model can incorporate all the possible factors that cause urban growth we assume that any model selectively focuses on a specific aspect

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and depicts a simplification of urban dynamics. Thus, this paper focuses on the dynamics of land use and transport infrastructure using a simple urban model for the periurban area of east Thessaloniki. Practical issues associated with the availability of data, calibration results and forecasting procedures are explored.

Modelling Urban Dynamics

Modelling urban dynamics presupposes an understanding of cities as a system of networks and flows. Therefore, in order to interpret space we must comprehend how flows and networks function as one system. Critical elements that define urban dynamics are the size of cities, their internal order, transport routes and the location of their activities (Batty 2013).

The location of specific activities illustrate the spatial organization of the network of socio-economic activities. Furthermore, the transport system connects the various activities and land uses by overcoming their physical separation, but at the same time increases mobility and accessibility, which may create new time-space relationships between land-uses (Rodrigue 2013). In addition, transport infrastructure occupies a significant part of the available space, especially in urban areas and may result in fragmentation and segregation effects (Seiler and Folkenson 2006; EC 2013).

Simulation models that correspond to this approach are the spatial interaction models. The first generation of these models were static synthetic economic and spatial interaction models. Their theoretical background is related to the science of regional economics, locational theories and urban economics. Thus, they embody the principle of land suitability, as a result of the interaction between factors determining economic production. From a mathematical point of view choice of location is determined by exponential or logarithmic models based on the method of utility maximization and entropy or random utility by setting limitations to the cost of transport, which in most cases is determined by income. These mathematical models calculate the probability of occurrence and establishment of an urban activity taking into account all the factors mentioned above (transport, rent, etc.). They incorporate the standard four-stage transportation modelling process consisting of trip generation, trip distribution, modal split and modal assignment and therefore are very suitable for an integrated land use transport approach.

In this paper, the TELUM-Transportation Economic Land Use Model (http://www.telus-national.org/products/telum.htm) is used to study urban dynamics in the periurban area of Thessaloniki. TELUM is a land use transport interaction model that attempts to replicate how networks, activities, population and flows are interrelated within an urban system. More specifically, TELUM attempts to replicate the interactions of the city's components (households, employers, developers and government) and record their consequences in a systematic way. It does not explicitly model every interaction, but it views them from an aggregative perspective. It focuses on how employment and its location affect the future location of

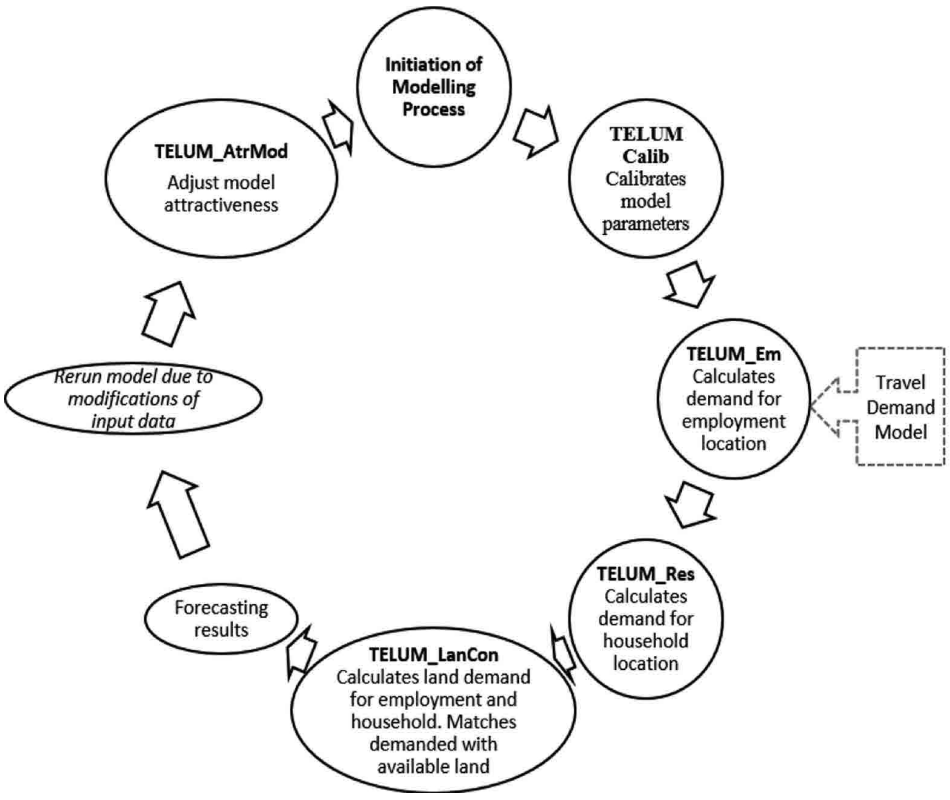

Fig. 1 Structure of the TELUM model.

households, and in turn, the implications for the land-use development patterns in the region.

From a functional perspective, the modelling process in TELUM starts with the calibration of the model parameters for both the employment and residential allocation models (Fig. 1). It continues with forecasting employment and household growth and calculation of the associated demand for land. Based on the demand for land forecast, the system estimates the changes in the different types of land use (i.e. land for tertiary employment, high income households etc). If the user desires to make any changes in the forecasts produced by the model, i.e. incorporate local knowledge into the system, this can be done by adjusting the attractiveness of certain types of land use (Putman 2005).

The Case Study of East Thessaloniki

Greece does not have any tradition or experience of using predictive methods for land use planning and recording urban dynamics, a practice that has been quite commonly used in most west European and U.S. cities since the early 1960s. Therefore, simulation models have not been used to capture land use dynamics in the city of Thessaloniki. In general it was not until 1980 for Athens and 1997 for Thessaloniki that the first study of transport was conducted, when both cities had already experienced rapid suburbanization. To be more specific in the case of Thessaloniki this was the first and only time that such a study was ever performed. Nevertheless because of the extensive acquisition of mobility, demographic and land use data this was a high quality study.

Located in the eastern part of Thessaloniki's greater urban agglomeration the study area consisted of two municipalities, the Municipality of Kalamaria and that of Pylaia (Fig. 2a). The city (urban agglomeration) of Thessaloniki is the second largest city in Greece (after Athens), and one of the largest urban centers in the Balkans. Since the early '80s the greater area of Thessaloniki experienced tremendous changes in terms of its morphological and functional organization. Key developments were a rapid urban expansion and formation of a "new city" that lacked defined boundaries and a center(s). New high-speed freeways (in conjunction with no investments in public transport), shopping centres, research and development (R&D) facilities and companies' headquarters were scattered in the peri-urban area. At the same time, suburban housing became accessible and affordable for middle and low-income families, increasing housing demand and therefore becoming the main form of residential development.

The two municipalities studied were part of the urban expansion. To be more specific from 1991 to 2011 the Municipality of Pylaia experienced a tremendous increase in population (51%) while the rest of the urban system either experienced a decline or no significant change. Main reason for this was the spatial proximity of Pylaia to Thessaloniki's dense urban area and the presence there of an attractive environment for household relocation due to a low residential density (mean floor area ratio 0.9) and presence of a natural environment. Except for the planned, mainly residential areas, Pylaia also had extensive areas that didn't have a designated land use so that practically any activity could be located there. This is a peculiarity of the Greek planning legislation, according to which any peri-urban, ex urban and rural area is potentially developable land (for residential, commercial etc. uses). In addition, this was the area that most of the new shopping centres, R&D facilities and company headquarters were located due to the large amount of available developable land and its proximity to the airport and city of Thessaloniki (Fig. 2b).

On the other hand the municipality of Kalamaria had a quite different urban development profile since its whole area is part of the dense urban area of Thessaloniki. This municiplaity did not experience dramatic population changes over the last three decades due to the fact that this area had been under development for many decades. With a mean floor area ration of 2.9 it has a quite dense urban environment that was almost 100% fully developed. It is also primarily a residential area with the exception of certain central axes where facilites for recreation and providing services were developed.

Data Availability and Acquisition

Acquiring appropriate data for the model, is probably the most difficult, time consuming and tedious task in the modelling process. TELUM requires five types of data: population, employment, households, travel cost and land uses. Table 1 presents the type of data required to run all the modelling steps, along with their spatial and temporal reference. Souce of data used to run the model is also denoted.

Table 1 TELUM Basic Data Requirements.

Type of Data	Spatial Reference	Temporal Reference	Source
Population control totals	Regional/ TAZ	Lag-1991	Census
Employment control totals by sector	Regional/ TAZ	Lag-1991	Census
Households by income	TAZ	Current-1997	TS
Employment by sector	TAZ	Current-1997	TS
Interzonal travel cost	TAZ	Current-1997	TS
Land use (Total and by type)	TAZ	Current-1997	TS
Average number of employees by household type	TAZ	Current-1997	Uniform dist
Households (by income) per employees (by sector)	TAZ	Current-1997	Uniform dist
Regional rate of employee commutation	Regional	Current-1997	Default value

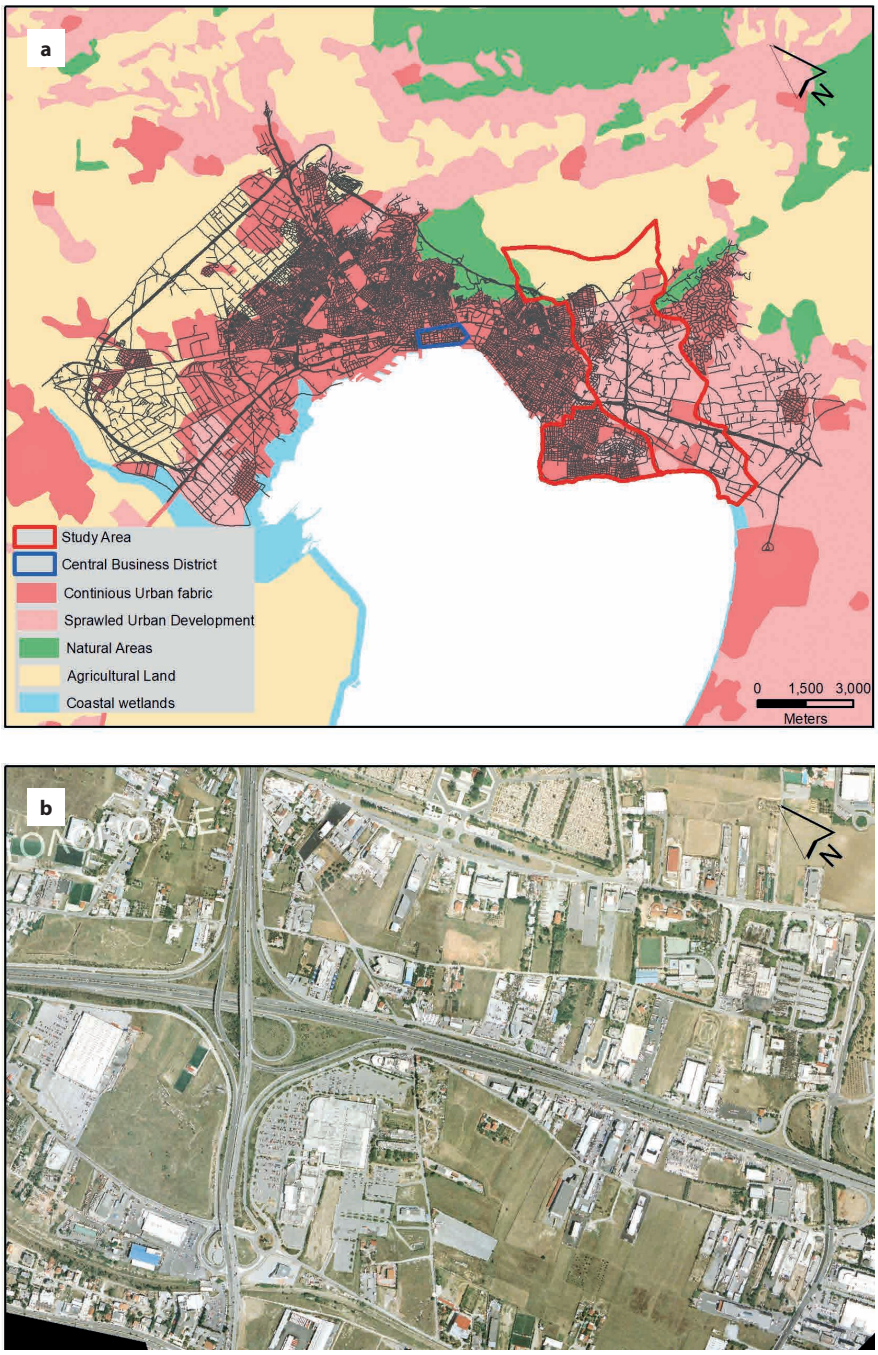

Fig. 2 (a) Location of the study area in the city of Thessaloniki **(b)** Big Box and R&D development, National Cadastre and Mapping Agency S.A.

In terms of the data's temporal reference, it is predetermined since there is only data on transport for 1997, it is inevitable to set 1997 as the "current year" for the calibration and forecasting purposes. Therefore 1991, which is the preceding census year, becomes the "lag year". This results in a six year time interval, which is close enough to the five years that is considered to be the ideal time interval for modelling purposes. Fortunately employment, household and land use data are available in the 1997 study on transport. In terms of spatial reference Transportation Analysis Zones (TAZ) were used for most of the required data since this was the only spatial level for which such data was available for carrying out the calibration process. It was also the only spatial level for which there was data for employment by sector at the place-of-work and not the place-of-residence (Pozoukidou 2014).

In terms of the land use data five different land use categories for each analysis zone is required. The categories are: total zonal area (study area), residential area (by household type), commercial area (used for commercial and third sector employment), industrial area, unusable area (e.g. water, environmentally sensitive lands, land with developmental constraints), and vacant developable area. Finally transportation data (zone to zone travel time, travel costs or a composite of both) were also necessary. Most of the required data were available in the transportation study but extensive readjustments had to be done in order to match the available with the trans-

portation study data to provide data required for the TELUM (Zarov 2016).

The Modelling Process

The 40 TAZ includes the study area with a population of 130,000 inhabitants (1997 estimation). The four basic employment sectors used for the modelling process were a) "Basic" including primary and secondary sector employment, b) "Retail services" including employment in retail services (wholesale included), c) "Public services" including public services but also private provided services such as health, education etc. and d) "Advanced services" that includes finance, consulting, engineers, lawyers etc. All employment data were calculated at place-of-work per TAZ for 1991 and 1997. In terms of household data four income based household types were designated. These were "low income", "middle income", "upper middle income" and "high income" per TAZ for 1991 and 1997. In terms of land use data five land use categories were used for each analysis zone, as described earlier.

All these data along with that on transport were entered into the "Data Organization and Preparation Unit" of TELUM. In this module TELUM performs a data consistency check in order to evaluate the quality of imported data. Results indicated high correlations between different pairs of data. More specifically, total current households and total lag households are closely correlated. The same applies for the four employment sectors. A high correlation between lag and current employment, in any employment sector (i.e. in "Basic" sector), indicates little or no change in the locational behaviour of that specific type of employment. Practically these data inconsistencies derive from the fact that both of the sets of employment data for 1991 was "constructed" in order to fit the model requirements, since there was no suitable data in the respective Census counts. In any case these types of data inconsistencies affect the validity of results and the respective variables should be replaced as more reliable data becomes available.

The next step in the modelling process is the calibration of the models embedded in TELUM. In specific terms calibration is the process of fitting the residential and employment models into the real world by estimating the parameters for each locator type (i.e. high income households, basic sector etc), which will be used in the models' equations. These parameters will be the ones that best fit the general model structure of the dataset and minimize the discrepancies between the model results and real data.

One of the first measures used for the best fit analysis is the Best/Worst Likelihood Ratio (B/W LR), which is a normalized maximum likelihood criterion. B/W LR is analogous to the R^2 measure but more appropriate for the nonlinear equations of TELUM and non-normal distributions of the data. Another set of goodness-of-fit measures examines the distribution of residuals (or errors) between the observed data and the models' current best-fit estimates. For this the Mean Absolute Percent Error, or MAPE, is commonly used. This is the average (mean) of the absolute values of percentage error between an observed set of say, household data and the values estimated by TELUM. Unfortunately, the value of MAPE can be easily distorted by large percentage errors in small zones. For example, if a zone with an observed ten households is estimated to have fifteen, it is a 50% error. If a second zone with 1000 observed households is estimated to have 1050, it is a 5% error. The value of MAPE for these two zones taken together is 27.5%, a value that exaggerates the forecast error of the model. One way to deal with this bias is to state the value of MAPE for just the smallest and largest observations (zones) in the data set along with the MAPE for all the zones taken together. In that comparison, we might see a MAPE of 500% in the smallest zones (which account for 2% of the region's low-income households) and a MAPE of 12% for the largest zones (which account for 87% of the region's low-income households). The MARMO measure is another way to give error measures that are weighted by the size of the observation and is a good summary measure of likely errors in forecasts. The best, and unachievable, value for MARMO is 0.0, which would indicate a perfect fit of model to data. Normal values of MARMO vary from 10.0 to 40.0 for each locator type. The measures of goodness of fit based on the calibration process were quite satisfactory. Table 2 shows a summary of the calibration results for employment, where the three goodness-of-fit indicators are presented with their values. The B/W LR for the four employment sectors are high indicating that employment data fits very well the employment model. At the same time the MAPE values are quite low indicating that the estimated parameters for the employment model equation are the best-fit since the percentage of error between observed and model's current best fit estimates, for each one of the locator types, are within the acceptable range. The MARMO values are also acceptable.

Table 2 Employment Goodness of Fit.

Employment Sector	B/W LR	MAPE	MARMO
Basic	0.9950	9%	8%
Retail	0.9763	36%	31%
Public services	0.9961	18%	18%
Advanced services	0.9334	23%	23%

Table 3 Household Goodness of Fit.

Household Cat.	B/W LR	MAPE	MARMO
low income	0.9421	84%	16%
middle income	0.9762	44%	15%
upper middle income	0.9094	34%	19%
upper income	0.8432	40%	29%

For households, the B/W LR results are high indicating that the household data fit the household model (Table 3). At the same time MAPE values are at the high end of the acceptable range indicating that the estimated parameters for the respective model equations are not the best-fit model since the percentage of error between observed and the model's current best fit estimates for each one of the locator types are at the high end of the acceptable range. MARMO values are acceptable.

Proceeding to the calibration of the land consumption model it seems that the overall goodness of fit of the model for all household types and "Basic" employment sector is 73% and 69%, respectively, indicating that the model can account for the majority of the zonal variation in the change in the use of land for housing and industry but cannot be a good predictor of it. On the contrary for retail, public services and advanced services the equation can account for most of the zonal variation (85%) in land use and can be used to make reliable predictions of these types of land use.

The last step in the modelling process is forecasting spatial allocation for employment and households in the study area. In order to do this it is essential to have the future (forecast) travel impedance. Since this was not

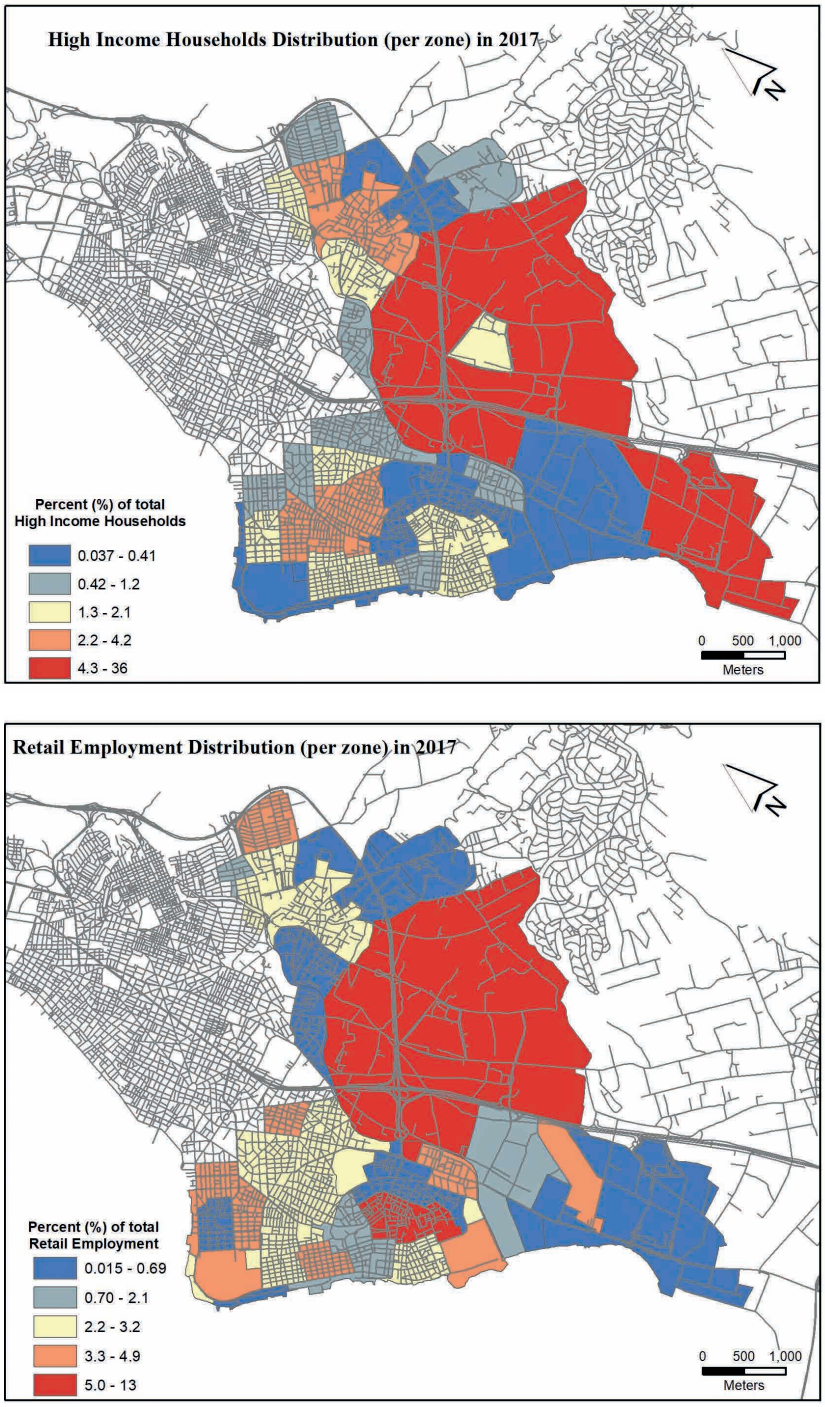

Fig. 3 Forecasts for high income households and retail employment in 2017.

possible a baseline scenario was developed. In this scenario it is assumed that there will be no change in transport infrastructure, therefore, forecasts will be based on an observed level of activity, and calibrated attractiveness variables are obtained from the current year's data (travel impedance). The current year for the baseline scenario is 1997 and four 5-year time intervals were set for forecasting purposes (1997–2002, 2002–2007, 2007–2012, 2012–2017). Finally forecasting was also based on the future regional employment and household projections that were imported earlier into the system.

According to the forecasts there will be a 24% decline in the study area in the basic employment sector, while retail, public services and advanced services will increase by 25%, 4% and 4%, respectively. In terms of households an increase of 10–14% for all four household types was recorded. In general, as expected, the model predicted an increase in population and household numbers as well as in the numbers employed in the tertiary sector. It is not possible to present the spatial distribution for each locator type and thus only a sample of the TELUM's outputs for the 2012–2017 forecasting period are depicted in the maps (Fig. 3). It is interesting to note that the model predicted an allocation of retail employment mainly at the fringe of the dense urban area, along the two main road axes, which gradually decreases as we move further south.

Conclusions: Simple Models for a Complex World

Production of urban space is neither a simple or an easy proccess to comprehend. It requires an understanding of the dynamics of an urban system and the complex procedures required for city growth. Attemps to model urban dynamics have led to extremely complex models, which attempt to consider the multiple interactions within an urban system. To this end various mathematical models have been developed using basic notions of complexity theory and have evolved around the concept of non linearity and multiplicity of states that a system can achieve.

This paper views mathematical models as a new opportunity to explore spatial relations, which include new evolutionary approaches. Taking into consideration that the world is complex and no model can incorporate all the possible factors that cause urban growth, we accept that models selectivelly focus on a specific aspect of urban dynamics. Along these lines this paper focuses on a specific aspect of urban development that incorporates the interaction between land use and transport infrastructure. A simple urban model for the periurban area of east Thessaloniki is used to record practical issues related to data availability, calibration and forecasting procedures.

Given the fact that there are no records of such models being used for the planning of Greek cities over last 25 years , makes this paper a critical contribution that supports the use of models in a Greek setting. Applicability assessment of the model was made for the three different modelling steps, i.e. data acquisition, calibration and forecasting, and the issues of data availability and standardization.

In particular, the data available for Thessaloniki lacked appropriate spatial and temporal references. The inevitable choice of TAZs as analysis zones created several problems in terms of obtaining appropriate data for the model, especially that related to employment at the place-of-work and land use. Despite data inconsistencies, calibration results indicated that employment, household and land use allocation models can account for most of the zonal variation in each locator type and can make reliable predictions. In an effort to highlight the usefulness of land use models as policy evaluation and decision making tools a future development scenario was also attempted. The available dataset enabled us to predict land use changes from 1997 to 2017 in 5 year increments. Results were comparable to the existing situation in 2017 indicating that despite the lack of data and certain assumptions the embedded models are suitable for use in Greek cities.

Finally, application of TELUM highlighted the importance of using urban models for planning, even using imperfect data, since it is important to understand the undelying interrelations within urban systems, which in turn will enable us to make better planning decisions about the future of our cities.

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ASPECTS OF MARINE SPATIAL PLANNING AND GOVERNANCE: ADAPTING TO THE TRANSBOUNDARY NATURE AND THE SPECIAL CONDITIONS OF THE SEA

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ABSTRACT

Extension of spatial planning from land to the marine space has recently become a key procedure for tackling the growing environmental and blue growth related challenges. However, given the transboundary nature of the sea (facilitating the flow of all kinds of materials and calling for special considerations in terms of resource and ecosystem management) not all the philosophy, planning models and procedures can be "transplanted" from terrestrial to marine spatial planning. Governance issues are subject to the same limitation.
This paper discusses key differences in the marine environment (compared to the land), which affect marine spatial planning and governance and is structured around the following key issues: (i) the public status of the sea, which involves a wide spectrum of stakeholders (among them the maritime regimes), (ii) the sovereign rights in the sea that are not separately defined by each state but by UNCLOS (especially beyond the territorial waters), (iii) the geopolitical constraints on proclaiming EEZs that reduce the area within which each coastal country can practice MSP, (iv) the usually non-defined administrative limits in the marine parts of a coastal country that impede decentralization of competencies and decision making, and (v) the lack of geospatial and socio-economic and cultural data, which creates uncertainty both for the planners and decision-makers.
This article concludes by highlighting the need for adopting a tailor-made MSP research agenda and by stressing the need to enhance cross-border cooperation as well as to make transboundary considerations when planning in the sea.

Keywords: marine governance; Marine Spatial Planning (MSP); transboundary MSP

Introduction

The need for extending spatial planning from land to sea

Oceans and seas cover more than two thirds (2/3) of planet Earth. However, it was not until recently that marine space has become "home" to a constantly growing number of activities and human uses (Orams 1999). Indeed, improvements in technology make it much easier than ever to both exploit marine resources at great distances and greater depths and construct resilient infrastructure and facilities in seas for the operation of several economic activities (Hall 2001). As a result, the spectrum of human uses taking place in the sea has grown to include, apart from traditional activities (such as navigation and maritime transport, fisheries, etc.), extraction of hydrocarbons and aggregates; energy production; aquaculture; tourism and leisure; research and protection of the marine natural and cultural heritage; military uses and so on (Smith et al. 2011).

However, these new trends in the use of the sea are not always beneficial and without adverse effects. As recent research indicates (e.g. Millennium Ecosystem Assessment 2005), the constant growth of sea uses (both in volume and number), has resulted in serious alterations in marine biodiversity and damage to marine ecosystems, due to their unplanned management and allocation (Smith et al. 2001; Douvere 2008; Maes 2008). In fact, it is documented worldwide that not only scarce marine resources are threatened by exhaustion and degradation, but also the ability of the ecosystem to keep delivering valuable services both to the environment and to humans (Gilliland and Laffoley 2008).

Considering these facts, extending spatial planning from the land to the sea has recently become a high priority globally, including in the European Union. Having full acknowledgment of the threats that the marine ecosystems are facing, more and more international organizations (or even sole countries) are turning their interest towards a relatively new procedure: Marine/Maritime Spatial Planning (M.S.P.), which is "about planning when and where human activities take place at sea – to ensure these are as efficient and sustainable as possible" (European Commission). MSP is constantly gaining ground for being the key procedure to ensure protection and wise management of the oceans and seas, by tackling the growing competition among marine activities (user-user conflicts), and by ensuring the continuous flow of ecosystem services in the fragile coastal and marine space (user-environment conflicts) (Ehler and Douvere 2008). At the same time, beyond being a process for allocating the different marine uses, MSP also has a strong cultural dimension and is a creative social process of building attractive identities for the sea, to create blue growth and jobs.

However, even though spatial planning has a long tradition on land (terrestrial spatial planning – TSP), not all procedures, philosophy and planning styles can be automatically "transplanted" to MSP (Papageorgiou 2017). The transboundary nature of the sea calls for special consideration in terms of governance and planning

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in marine space. This fact has been largely acknowledged and highlighted by many policy documents, among them those from the EU and U.N. (such as the MSP Directive, the Marine Strategy Directive, the Barcelona Convention and Protocol, and so on) (Fernandes et al. 2013). At the same time, the need for adapting to the transboundary nature of the sea is also reflected in the efforts to conform to a more area-based approach (also known as the Ecosystem Approach), instead of thinking on a geopolitical or sectoral basis when planning in the sea (Hammer 2015; Van Tatenhove 2011).

Given the above context, the present paper explores differences and peculiarities of marine space (related to the transboundary nature of the sea) that should be considered in marine governance and spatial planning. To this end, this paper begins with theoretical and conceptual issues related to "marine spatial planning" and "marine governance" and continues with a discussion of the peculiarities of the sea that affect the way that spatial planning and governance should be practiced in marine space. The ultimate scope of the paper is to contribute to the emerging discussion on how to achieve integrated spatial planning and good and wise governance in marine space, taking into consideration existing planning practices from the land and TSP and the transboundary nature of the sea.

Governance and spatial planning in marine environments

Marine spatial planning and the ecosystem approach

Terrestrial spatial planning (TSP) is considered to be far more developed than marine spatial planning (MSP). However, the fact that so far there are very few marine spatial plans world-wide does not necessarily mean that planning in marine space has rarely been practiced up to now. On the contrary, planning in the sea has been very common for a long time, all over the world, on a sectorial basis (Beriatos 2013). The oldest planning attempts regard fishery zonings (to support food and alimentation) and navigation networks (for maritime transport) accompanied by port infrastructures and facilities. Later, in the beginning of the 20th century, sectorial planning attempts included mineral extraction (aggregates, hydrocarbons, etc.), whilst most recently, marine planning has been concerned with a range of other economic activities, such as those related to offshore renewable energy sources (wind power, wave power, etc.) to aquaculture and so on (Smith et al. 2011).

Today, however, when sea uses are constantly growing both in volume and in number, planning in marine space is under reconsideration. The sectorial approach that has prevailed in the sea up to now, even if beneficial according to some scholars (Crowder et al. 2006; Maes 2008; Foley et al. 2010), is being challenged by a more area-based planning approach: the Ecosystem Approach (EcAp)[1] (Kyvelou 2017). The Ecosystem Approach has been widely adopted by most U.N. and EU documents related to the marine environment (such as the ICZM Protocol, the MSP Directive 2014/89, etc.). According to this area-based approach, spatial planning in marine space should no longer be practiced per sector or per economic activity. Instead, it should be practiced within ecosystem boundaries (marine regions), so that a wiser management of all uses (marine or coastal) and of the environment can be achieved (Douvere 2008; Beriatos 2013; Papageorgiou 2016).

The fact that the ecosystem (or area-based) approach to marine spatial planning is currently receiving more and more attention is due not only to recent environmental concerns but also to the dynamic and transboundary nature of the sea that crosses administrative and national boundaries. This calls for planning initiatives on a wider regional or sea basin scale (Gilliland and Laffoley 2008). However, even if the area-based approach is rather common when planning on land (TSP), not all experiences, philosophy, procedures and planning models and styles can be applied when planning in marine space. Furthermore, pathologies of the TSP, especially in countries that suffer from a series of spatial planning and governance deficiencies, should never be transposed to the MSP process (Kidd 2012; Kyvelou 2016). In fact, a thorough analysis of current attitudes, trends and lessons learnt from MSP world-wide (Kyvelou and Pothitaki 2017) can lead to the suggestion of a tailor-made MSP research agenda for different types of countries and sea-basins that can be linked with the specific evolution of national terrestrial planning systems and the need to investigate further the modes of integration of MSP within national planning systems. This was, in fact, a demand of the Territorial Agenda 2020 of the EU[2] on the basis of the land-sea interaction (LSI) principle.

Marine governance

The term "governance" is of Greek origin: "kyvernan". Governance is a special term that can be defined in different ways (Lalenis 1993; Rhodes 2000), from country to country (Kohler-Koch 1999) or even within each country (Loughlin 2007). According to the U.N. Development Program, governance is defined as "the rules of the po-

1 The Ecosystem Approach is a rather well-known concept among marine biologists since the 1980s and is defined as "the comprehensive integrated management of human activities based on the best available scientific knowledge about the ecosystem and its dynamics, in order to identify and take action on influences which are critical to the health of marine ecosystems, thereby achieving sustainable use of goods and services and maintenance of ecosystem integrity" (ICES, 2003).

2 The EU Territorial Agenda clearly states: "Maritime activities are essential for the territorial cohesion in Europe … The Marine Strategy Framework Directive and the EU Integrated Maritime Policy call for coordinated actions by the Member States for the successful implementation of the MSP. This planning should be integrated into the existing national spatial planning systems in order to achieve a harmonious and sustainable development of the regions that include both marine and land areas (land-sea continuum)".

litical system to solve conflicts between actors and adopt decisions (legality)" and also as the "proper functioning of institutions and their acceptance by the public (legitimacy)".

Regarding territorial governance, the CEMAT (*Conférence du Conseil de l'Europe des Ministres responsables de l'aménagement du territoire*) defines it as "a global concept which characterizes the way spatially-relevant policies, considered together, are applied". According to the same institution (CEMAT), territorial governance is described as "the result of multi-level and cross-sectoral relationships in the field of public policies", also referring to "horizontal and vertical cooperation in the shaping and implementation of these policies". Faludi (2012) notices that in some circles the term territorial governance has lately become synonymous with spatial planning. Nevertheless, territorial governance is responsible for drawing borders, defining the autonomy and the way that territories are governed, defining patterns of co-operation and collaboration, both between governmental and non-governmental actors and between levels of government (Lidström 2007). At the same time, as stressed in the Handbook of CEMAT-YPEN, "for territorial democracy and planning participation in spatial planning" (announced in 2014 during the Greek Presidency), territorial governance is directly connected with "public participation". On the other hand, spatial planning is about allocating functions and infrastructure, identifying urban and economic poles and networks, setting the grounds for economic, social and environmental development and promoting territorial cohesion.

Considering the above, "marine governance" does not differ from "territorial governance", since it has the same objectives and purpose: trying to involve all competent authorities and stakeholders in maritime spatial planning procedures, in a meaningful way (Kraan et al. 2014). According to Van Tatenhove (2011), marine governance is defined as "the sharing of policy making competencies in a system of negotiation between nested governmental institutions at several levels (international, supra national, sub-national) on the one hand and state actors, market parties and civil society organizations of different maritime activities on the other in order to govern activities at sea and their consequences".

Good and wise governance is equally as important to MSP as it is to TSP. However, as in the case of marine spatial planning (MSP), exercise of marine governance should adapt to the transboundary nature of the sea, i.e. take place at a marine regional level rather than considering the geopolitical boundaries, thus limiting governance procedures solely within each coastal state (Hammer 2015; Van Tatenhove 2011). This means that if wise marine governance is to be achieved, it is important to enhance transboundary cooperation at an institutional level, among competent authorities from all the coastal countries sharing the same sea. At the same time, it is also important to ensure meaningful involvement of all stakeholders related to the sea, including maritime regimes (Kraan et al. 2014).

Van Tatenhove has further developed this issue and argues that TMSP (transboundary MSP) should be developed as a reflexive governance arrangement, in which actors would be able to challenge dominant (nationalistic) discourses of MSP, in order to change the institutional rules of the game and develop new institutional rule systems (Van Tatenhove 2017). He suggests three main conditions to achieve this: rule-altering politics, knowledge production and sharing of information, and development of the so-called bordering capabilities versus traditional borders (Sassen 2009), that would change the institutional rules and challenge the discursive space of national marine planning discourses.

This is a ground breaking proposition that certainly fits in with globalisation trends and with the evolving shift of interest towards the partimonialization of the sea versus its jurisdictional dimension (Kyvelou 2016) and the necessity of introducing global marine governance arrangements, at least at the macro-regional level and level of sea-basins.

Peculiarities of the sea to be considered in marine governance and planning

The transboundary nature of the sea

The sea is space of a particular nature, compared to the land (Coccossis and Beriatos 2016). It constitutes a fluid mass that facilitates the unimpeded flow of materials, including substances, fish, waste and so on. And despite the fact that it forms a "blue continuum" (one sees nothing but a water surface), the sea constitutes a multidimensional space, including the sea bed, the water column and the surface of the sea (Papageorgiou 2016).

The fact that in the sea no physical boundaries exist, and marine ecosystems and resources transcend administrative and national boundaries, calls for special consideration in terms of marine governance and spatial planning. First of all, resource management has to be considered on a transboundary basis, in order to avoid conflicts among neighbouring countries, and therefore, to ensure viability of marine economic activities for all sides. Second, ecosystem management has to be also considered on a transboundary basis, in order to avoid exceeding the carrying capacity (of shared or adjoining ecosystems) and to avoid marine habitat fragmentation of transnational marine ecosystems (Jay et al. 2016).

Adapting to the transboundary nature of the sea is of prime importance when implementing MSP. However, transboundary MSP considerations and initiatives may face two kinds of challenges (Flannery et al. 2015; Van Tatenhove 2017): institutional and conceptual. Institutional challenges come as a result of the fragmented responsibilities and the different kinds of authorities, institutions,

policies and regulations existing in a marine region that is surrounded by multiple countries or administrations (Raakjaer et al. 2014; Jay et al. 2016). In fact, such institutional plurality may result in contradictions in decision making, overlapping of competences, as well as misfortunes in governance, causing delays and negatively affecting the efficiency of MSP (Fernandes et al. 2013; Jay et al. 2016; Van Tatenhove 2017).

Conceptual challenges, on the other hand, may come as a result of different approaches among countries sharing the same sea region, regarding the planning and management of their marine space (Van Tatenhove 2017). For example, some countries conceptualize planning and management of their marine parts using the ICM (Integrated Coastal Management) approach, whilst other countries prefer to separate marine planning from that of the land and stick solely to the sea. In other cases, conceptual challenges derive from the fact that some countries are quite advanced in MSP implementation, whilst others are in an experimental phase concerning MSP practices (Flanerry et al. 2015). Differences in the planning approach and the marine planning experience, as well as incompatibilities in the Plans and the planning and management objectives of shared marine regions, may result in serious difficulties in practicing MSP, especially in cases where the distance between neighbouring coastal countries is very close.

Given the above, it becomes evident that the transboundary nature of the sea should always be considered in every planning implementation applied to marine space, and especially in shared marine regions. At the same time, cross-border cooperation as well as transboundary considerations should be a *sine qua non*, if effective marine spatial planning is to take place. This is particularly necessary, due to the growing political interest in transboundary maritime spatial planning, mostly based on Art. 11 of the MSP Directive that explicitly refers to the need for cooperation between Member States bordering on marine waters. The aim is to ensure that maritime spatial plans are coherent and coordinated across the marine region concerned, indicating that such cooperation shall be pursued using the existing regional institutional cooperation structures (e.g. Regional Sea Conventions); networks/structures of Member States' competent authorities; and/or any other method (e.g. sea-basin strategies).

Jurisdictions and other legal aspects

The sea significantly differs from the land in terms of jurisdictions and sovereign rights. Up to the territorial waters (T.W.), absolute jurisdiction falls under the coastal states. Beyond T.W., marine space is regulated almost exclusively by the International Law of the Sea (UNCLOS). This means that beyond a certain point, jurisdictions and rights are not only a matter of each coastal state, but also the concern of the international community, resulting in a series of limitations.

According to UNCLOS, territorial waters of coastal countries (i.e. the marine space within which each coastal state has absolute jurisdictions) can extend up to 12 n.m. Beyond territorial waters, each coastal state has the right to proclaim extra zones, the most common of which are the Continental Shelf (C.S.) and the Exclusive Economic Zone (EZZ). However, even in the case that such zones are proclaimed, jurisdictions and rights are not the same as in T.W. As presented in Table 1, coastal countries have less rights within C.S. or EEZ compared to those within T.W. Sovereign rights within the C.S. refer only to the seabed and subsoil of the submarine areas that extend beyond the territorial seas of a country, whilst sovereign rights within the EEZ of a coastal country regarding exploitation, conservation and management of the natural resources (living or non-living), of the waters superjacent to the seabed and of the seabed and its subsoil.

However, even though UNCLOS gives the right to proclaim extra zones, this has not been achieved by many coastal countries. Existing geopolitical conflicts among States sharing the same marine regions may result in extreme difficulties in the proclamation of extra zones beyond the territorial waters, thus hampering the ability of coastal countries to benefit from their surrounding seas.

Considering the above, if effective Marine Spatial Planning is to be achieved, it is essential that coastal countries proclaim their outer marine national limits (and more preferably their EZZ), in order to enlarge the area within which they can implement MSP, and therefore take full advantage of the marine resources, economic opportunities and ecosystem services that their surrounding seas can offer them.

Table 1 Jurisdictions and rights in marine space.

TERRITORIAL SEAS	
Breadth (art. 3)	Every State has the right to establish the breadth of its territorial sea up to a limit not exceeding 12 nautical miles, measured from baselines determined in accordance with this Convention.
Legal status (art. 2)	The sovereignty of a coastal State extends beyond its land territory and internal waters, and in the case of an archipelagic State, its archipelagic waters, to an adjacent belt of sea, is described as the territorial sea. This sovereignty extends to the air space over the territorial sea, as well as to its bed and subsoil. The sovereignty over territorial sea is exercised subject to this Convention and to other rules of international law.
CONTIGUOUS ZONE	
Breadth (art. 33)	The contiguous zone may not extend beyond 24 nautical miles from the baselines from which the breadth of the territorial sea is measured.
Legal status (art. 33)	In a zone contiguous to its territorial sea, described as the contiguous zone, the coastal State may exercise the control necessary to: (a) prevent infringement of its customs, fiscal, immigration or sanitary laws and regulations within its territory or territorial sea; (b) punish infringement of the above laws and regulations committed within its territory or territorial sea.

EXCLUSIVE ECONOMIC ZONE	
Breadth (art. 55, 57)	The EEZ is an area beyond and adjacent to the territorial sea. The EEZ shall not extend beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured.
Rights and jurisdictions (art. 56)	In the exclusive economic zone, the coastal State has: (a) sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or non-living, of the waters superjacent to the seabed and of the seabed and its subsoil, and with regard to other activities for the economic exploitation and exploration of the zone, such as the production of energy from the water, currents and winds; (b) jurisdiction as provided for in the relevant provisions of this Convention with regard to: (i) the establishment and use of artificial islands, installations and structures; (ii) marine scientific research; (iii) the protection and preservation of the marine environment; (c) other rights and duties provided for in this Convention.
CONTINENTAL SHELF	
Definition – breadth (art. 76)	The continental shelf of a coastal State comprises the seabed and subsoil of the submarine areas that extend beyond its territorial sea throughout the natural prolongation of its land territory to the outer edge of the continental margin, or to a distance of 200 nautical miles from the baselines from which the breadth of the territorial sea is measured where the outer edge of the continental margin does not extend up to that distance.
Rights (art. 77)	The coastal State exercises sovereign rights over the continental shelf for the purpose of exploring it and exploiting its natural resources. The natural resources referred to in this Part consist of the mineral and other non-living resources of the seabed and subsoil, together with living organisms belonging to sedentary species, that is to say, organisms which, at the harvestable stage, either are immobile on or under the seabed or are unable to move except in constant physical contact with the seabed or the subsoil. Article 60 applies *mutatis mutandis* to artificial islands, installations and structures on the continental shelf.

Source: UNCLOS Convention (processed by the authors)

Competencies and the public status of the sea

Property status within T.W. is quite different in the sea from on land. On land, property status varies considerably among private, public properties and so on. For most coastal countries, however, private properties do not exist in marine space (Beriatos 2016). The public status of the sea also calls for different considerations regarding marine spatial planning and stakeholders' participation, including maritime regimes (Kraan et al. 2014; Flannery et al. 2015) and limiting the (private) interest of the citizens.

At the same time, despite being public property, competencies within the territorial waters are usually a matter of public administration (Ministries, government bodies, etc.), instead of being shared with local administration (of all tiers). This fact comes usually as a result of the lack of defined administrative (sub-national) limits in the sea. In fact, in most coastal countries, administrative boundaries are defined only on land, i.e. they extend up to the coastline and not up to the outer marine borders of a country. As a result, competencies are rarely decentralized, keeping decision making regarding the use and protection of the sea at a central/governmental level.

Considering the above, if effective Marine Spatial Planning and marine governance is to be achieved, it is important that coastal countries proceed to define their sub-national (administrative) borders within the sea, so that competencies are decentralized and decision making for the management of seas is shared between all tiers of administration.

Sea, the "Terra Incognita": discussing the availability of marine and MSP data

Despite the extensive coverage of planet earth by water, oceans and seas are still considered to be "terra incognita". Indeed, availability of data for the sea is extremely limited, compared to that for land. The missing information (PAP/RAC and University of Thessaly 2015) is usually:

- geophysical data: bathymetric/terrain data, geological faults, sea streams, currents, tides, ripples, whirlpools, wind power, etc.
- ecosystem data: *Posidonia oceanica* meadows, coral reefs, etc.
- resource data: fish breeding areas, fossils, minerals, oil resources, etc.

Currently there is also missing information on the socio-economic and socio-cultural data for MSP, given that the latter is mostly an place-based policy (Ehler 2017; Kyvelou 2017; MSP data study 2017).

Beyond what is lacking however, existing data also fall into several restrictions. In fact, existing data are usually available at different resolutions and digital analyses, different formats (hardcopy maps, digital maps, etc.), different coordinate systems, or even different time-scales and they are not always free (Papageorgiou 2017).

The fact that existing data for marine space is limited and that available information is likely to be incompatible creates uncertainty when planning and making decisions regarding the sea. Collection of all the necessary data is very important before implementing MSPs. Therefore, coastal countries should proceed with the creation of the appropriate databases (with longer or shorter time-series, with broader or no geographical coverage), so that critical information is gathered and is accessible to planners as well as the competent authorities responsible for MSP decision making (Flannery et al. 2015). At the same time, given the transboundary nature of the sea, it is important that geo-spatial data are aligned and harmonized between countries sharing the same seas, in order to facilitate transboundary considerations and planning initiatives. In the EU this harmonization is in progress, after the adoption of the INSPIRE Directive.

Concluding remarks: the emerging need for a transboundary approach

Marine space constitutes a fragile ecosystem currently receiving tremendous pressure and facing many challenges and threats, due to growing competition for the marine resources and for the use of the marine space. Given these challenges, spatial planning models and techniques, which were traditionally terrestrial, become a *"sine qua non"* also for the marine environment. However, not all methodologies, concepts and philosophy from terrestrial spatial planning can be automatically "transplanted" to marine space.

Based on the analysis presented in the previous sections, the transboundary nature of the sea calls for special considerations in terms of planning and governance. In fact, the key particularities and differentiations to be considered in marine spatial planning and governance are:

i) The property status of seas, which is mainly under public authorities (at least within territorial waters of each coastal State). This creates a totally new spectrum of stakeholders to be involved in governance procedures, including maritime regimes, marine professionals and excluding citizens as individuals, given the fact they have no direct (private) interest in the sea.

ii) The legal aspects and jurisdictions related to the sea, that are not separately administered by each coastal state but by UNCLOS (especially beyond territorial waters). This limits sovereign rights and poses specific restrictions in the way each state may benefit from its surrounding seas.

iii) The constraints in proclaiming the EEZ (as a result of geopolitical conflicts and the partial implementation of UNCLOS). This reduces the vital area within which each coastal country can practice MSP, as well as the extent to which a coastal state may take advantage of the marine resources, economic opportunities and ecosystem services of their surrounding seas.

iv) The usually non-defined sub-national (administrative) limits in the marine parts of a coastal country that impede decentralization of decision making and of competencies related to the sea.

v) The lack of geospatial, socio-economic and socio-cultural data, confirming that both the sea and the marine geographical context are still, to a great extent, "terra incognita". This fact calls for special consideration, or even extrapolation, when spatial planning in the sea and, with respect to governance, creates uncertainty regarding the decisions to be taken by planners and by competent authorities and the stakeholders involved.

To conclude, implementing spatial planning and practicing governance in marine environments cannot just rely on experience acquired from the land. Instead, they have to be considered thoroughly and independently, having always in mind the peculiarities of the marine space (compared to the land), due to the special conditions and the transboundary nature of the sea. This means that when planning and governing the sea, cross-border cooperation among countries sharing the same seas is a *"sine qua non"*, as is the need to make transboundary MSP considerations, at least at the macro-regional and sea basin scale. The adoption of tailor-made reflexive MSP arrangements also has to be further subjected to more analytical research, mainly at the sea-basin level. These conclusions are fully consistent with the already declared political interest in Transboundary MSP (2nd Forum on MSP, Paris 2017) on behalf of supra-national organisations like the EC (DGMARE) and IOC UNESCO. This interest is mostly based on the 2014 MSP directive that aims not only to support a more efficient sustainable development of marine and coastal resources, but also strengthen cross-border cooperation and therefore improve ocean/marine governance (EC, EASME 2017). The time has come to translate the policy recommendations into tailor-made practical planning and governance methods and arrangements.

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URBAN ENVIRONMENTAL DEGRADATION: REALITIES AND HISTORICAL ILLUSIONS

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ABSTRACT

Every day citizens and visitors in Greek cities often find themselves constantly struggling with impediments: obstacles to their movement, their vision, to breathing air, etc. One cannot walk without being cautious so as not to stumble over a poorly repaired sidewalk, although it would have been easy to repair. You may find yourself next to the sea, but blocks of flats may hide it from you, restricting you to an endless maze, even though studies highlight the benefits for human health when coexisting with the natural bodies of water. One almost seems to be always close to roads with many car lanes and high traffic volumes; again despite the fact that studies highlight the adverse effects of car emissions on health. Why is this happening? Why do we choose and create such conditions? This paper attempts to shed some light on these questions by examining selected historical references to the 'promised lands' and some of the causes of the contemporary urban environmental degradation. The discussion focuses on an effort to comprehend the gap between the existence of urban environmental proposals and their lack of implementation at a greater scale, by (a) examining theories and proposals of major scholars concerning the environmental upgrading of urban space and by (b) examining the causes of the existing environmental urban degradation that currently affect many cities.

Keywords: contemporary urban degradation; health and urban degradation; history of urban environmental design; urbanization problems

Introduction

Being in a city often involves a certain degree of pain. More often than we might have hoped for, everyday life appears to be filled with impediments to all the primary needs of human beings, such as the need to breathe fresh unpolluted air. However, the exhaust fumes of cars and industrial facilities that cause air pollution are but only one effect, out of many, of urban degradation. This everyday reality, nonetheless, seems rather distant from many urban environmental proposals. From implemented examples, such as the Bo01 in Malmö, Sweden, to proposals of stunning imagery, such as Vincent Callebaut's 'Paris Smart City 2050', urban environmental projects appear truly captivating and promising. Indeed, while studying, researching and working in the field of urban environmental design one might be impressed by wondrous images, marvellous ideas and promising examples of the environmental 'promised lands' proposed by various researchers, scholars and professionals throughout history; surely alluring dreams, so much desired. Yet, more often than not, contemporary cities seem to fall short of these environmental 'promised lands', so much so that it may trigger troubling thoughts concerning their mere existence. Where could they be?

This paper, however, is not an attempt to find them. Instead, it tries to shed some light and draw attention to this curious phenomenon of the fact that although proposed solutions exist, for at least a couple of thousand years now, in terms of the environmental design of cities, their implementation and especially their long term and continuous application, appear to be somewhat deficient and in many cases totally absent.

This study will begin with a short exploration of 'past promised lands', mainly views throughout history concerning environmental notions and the city. Despite these conceptions, urban degradation is widespread. Then, we continue by discussing some of the causes that lead today to urban degradation, and we conclude with some closing remarks and a short discussion at the end.

Past Environmental 'Promised Lands'

One of the best known works on environmental urban design is no other than Vitruvius' *The Ten Books On Architecture*, the ancient textbook of good design and construction practices. Vitruvius (1st century B.C.) appears rather adamant in terms of what the architect/urban designer/urban planner needs to know 'the architect should also have knowledge of the study of medicine on account of the questions of climates …, air, the healthiness and unhealthiness of sites, and the use of different waters' (Vitruvius 1960). He then continues noting that the art of building is divided into two parts: 'the construction of fortified towns and works for general use in public spaces, and the second is the putting up of structures for private individuals' (Vitruvius 1960). Next, he marks the importance of a good choice of a site for a city, which needs to be 'a very healthy site' (Vitruvius 1960). He then refers to all those environmental aspects that he considers relevant. For example, he discusses the direction of the streets in terms of air movement, being rather meticulous about the effect of different winds on human health, and the way to block those that are considered unhealthy (Vitruvius 1960). Reading Vitruvius' work and particularly the above-mentioned parts, one cannot be but amazed by the environmental consciousness and the related design solutions that he presents. Surely, one might think, the world of his time had found and implemented these

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Fig. 1 A view of a central section of Athens, Greece (Photo: Syrakoy AC).

solutions, and the images of ancient cities were not only pleasing to the eye, but also environmentally pleasing. But were they truly? Indeed, ancient cities like Priene appear to have a design that does seem to follow the principles of environmental design: 'the site on which the city was founded was chosen according to criteria that applied generally to Hellenistic cities: to facilitate ventilation and to make the best possible use of sunlight, the building complex should face south and be built on different levels' (Dontas 2000). Yet, the city during Vitruvius' time, the capital of the Roman Empire, Rome, does not seem to have followed similar patterns, as accounts from that era portray a completely different picture. It is noted that 'Tacitus attributes the ease and speed with which the terrible fire of 64 A.D. spread through Rome to the anarchy of these confined streets winding and twisting as if they had been drawn haphazard between the masses of giant insulae' (Carcopino 1941). In addition, the majority of streets 'were daily defiled by the filth and refuse of the neighbouring houses and were neither so well kept as Caesar had decreed in his law, nor always furnished with the foot-paths and paving that he had also prescribed' (Carcopino 1941). Where is Vitruvius' 'promised land'? Again reality seems to be rather distant from what seems to be the 'right way' of doing things.

Certainly Vitruvius' example is not the only one to have provided guidelines for 'good' environmental design in contrast to what can be seen in everyday life. An interesting example appears in the work of Ibn Khaldûn in the 14th century. Similar to Vitruvius, he also highlights environmental concerns about how the selection of a site for an urban settlement and design of the city can affect health. For example, he notes that overcrowding in cities has resulted in degradation of air quality, leading to epidemics, and that: 'science has made it clear that it is necessary to have empty and waste regions interspersed between urban areas. This makes circulation of air possible. It removes the corruption and putrefaction affecting the air after contact with living beings, and brings healthy air. This is also the reason why pestilences occur much more frequently in densely populated cities than elsewhere, as for instance in Cairo in the East and Fez in the Mahrib'

(Ibn Khaldûn 2005). In general, Ibn Khaldûn appears to support the idea that the low air quality in cities as well as other factors, such as lack of exercise of their citizens, lead to health problems, in contrast to the inhabitants in rural areas (Ibn Khaldûn 2005).

Another supporter of the idea that the conditions in cities were not always desirable was Andrea Palladio in the 16th century. Interestingly he notes that a 'Gentleman' is sometimes 'obliged' to reside in the city, and then continues by referring to the advantages of having a house in the countryside where he can '… preserve his body strong and healthy … and the mind being over labored by the fatigues of the city, will be singularly recruited and recreated' (Palladio 1715). The 'Situation' of the buildings in the country appears to be of the outmost importance, since '… not being commonly (as in Towns) straitened for room by public buildings, nor confined by our neighbours to certain determinate bounds, it is the duty of an able Architect to find out with all care and diligence the most commodious and healthy places' (Palladio 1715) Palladio also highlights environmental concerns in the design of the city. For example, he begins his chapter titled 'Of the compartment of the Ways (or Streets) within the City' as follows: 'In the compartment, or distribution of the Ways in a City, or Town, regard must be ever had to the temperament of the air, and also to the region of Heaven, or the climate under which the place is situated: because where the air is cold or temperate, there the Streets ought to be made large and noble, since thereby the City will become more wholesome, convenient, and beautiful: it by being certain, that by how much less piercing, and withal by how much freer the air is, by so much more a Town is situated in a cold place, or in a piercing air, and that the houses are high, by so much the larger ought the Streets to be made, that they may be visited by the Sun in every part of them … But if a Town is situated in a hot climate, the Streets ought to be made narrow and the houses built high; that by the shade and straightness of the passage, the heat of the air may be tempered, and consequently that it may become more healthy …' (Palladio 1715).

By the end of the 19th century and early 20th century, the proposal of Sir Ebenezer Howard *Garden Cities* (1898 and 1902) (Howard 2001) appears to be yet another example of an attempt to introduce environmental design notions on the urban fabric. This study seems to have had a profound influence mainly in the UK, after World War II, when the New Towns Act (1946) adopted Ebenezer Howard's concept. The concept of the garden city has been also influential in the US as well as elsewhere.

Later, the Modern Movement showed initially environmental design sensitivities. For example, one of its leading figures, Le Corbusier (1887–1965), notes in his book *Towards a New Architecture*, the following: 'Instead of our towns being laid out in massive quadrangles, with the streets in narrow trenches walled in by seven-storeyed buildings set perpendicular on the pavement and enclosing unhealthy courtyards, airless and sunless wells, our new layout… would show great blocks of houses with successive set-backs, stretching along arterial avenues. No more courtyards, but flats opening on every side to air and light, and looking, not on the puny trees of our boulevards of to-day, but upon green sward, sports grounds and abundant plantations of trees' (Le Corbusier 1986).

However, despite Le Corbusier's best intensions, he was later accused that his Modernized ideas regarding pure minimal form, his favourite material reinforced concrete, industrial materials and methods, etc. 'could ruin the harmony of an entire townscape … and have … destroyed the appearance of the entire city' (Dalrymple 2009). In general, the Modern Movement has been possibly harshly, yet perhaps justly, criticized for quite a few things, such as for the deterministic views on how people are supposed to live their lives: 'when architecture develops without any consideration of the social conditions within which it operates, it is inevitable that the "purity" it aims for is no more than an illusion' (Heynen 1999); an illusion from whose ramifications we are still today, as it often seems, trying to free ourselves.

Looking at the above examples it becomes evident that guidelines and recommendations existed throughout history in terms of the environmental design of cities. Nevertheless, as it is perhaps also rather clear, these were most of the time design theories for a utopia, since they never fully worked in real everyday life. Why did this happen? Why does it seem so difficult to implement our environmental design ideas and instead are left to what seems to be an eternal struggle against urban degradation? As it seems, if we really want to be crowned winners of this fight, it is imperative to fully understand the core of this struggle, and hence to look at the causes of urban degradation. Perhaps these causes concerning the previously mentioned past examples are somewhat in part hidden into the realms of time, yet contemporary causes of urban degradation are more accessible to us and are certainly pressingly demanding solutions. Hence, we will proceed in viewing some of the more contemporary causes of urban degradation in order to understand the complexity of this issue.

Causes of Urban Degradation

Defining the causes of urban degradation seems to be a somewhat confounding subject. Researchers believe that: 'urban degradation appears to be a fact in several urban landscapes, with different characteristics, different historical development, in different cultural, social, economic and geographical environments, etc. Therefore, the causes of urban degradation may vary from region to region and from one time period to another' (Syrakoy 2012). However, if we were to name but a few, studies have shown that the main causes of contemporary glo-

balized urban environmental degradation, as is discussed below, are connected with the rapid and uncontrolled urbanization, the negative aspects of urban expansion (urban sprawl or/and compactness) and the devastating priority of economic growth.

The rapid and uncontrolled urbanization

According to the World Health Organization (WHO n.d.), 'the urban population in 2014 accounted for 54% of the total global population, up from 34% in 1960, and continues to grow'. WHO, through the Global Health Observatory (GHO) data, records the emerging trends concerning the global urban population growth: 'The global urban population is expected to grow approximately 1.84% per year between 2015 and 2020, 1.63% per year between 2020 and 2025, and 1.44% per year between 2025 and 2030.'

There are, however, countries, such as Greece, where the percentage of the population living in urban areas seems to exceed the 54% mentioned by WHO. The urban population of Greece appears to be continuously growing. The National Statistical Service of Greece (NSSG, 1983, 1993, 2004) shows that while in 1920 the urban population reached 38.1% of the total population, in the 2001 census it reached 75.1% (Chatzicocoli and Syrakos 2006). During this period, the sharpest growing curve is recorded between the 1961 and 1971 census, which '… indicates the period of time of the most rapid urbanization in Greece' (Chatzicocoli and Syrakos 2006). Nevertheless, a comparative levelness of the growth of the urban population is indicated by the censuses from the last decades (1981–2001), during which time '… the rate of urban population growth has been 14.77% per decade, approximately double the rate of the total population growth in Greece, which, for the same period of time, has been 8.14% per decade' (Chatzicocoli and Syrakos 2006).

More recent data (CIA 2016) shows that the urban population in Greece had already reached 78% of total population in 2015, while the annual rate of change (estimated for the period 2010–2015) of urbanization is 0.47%.

The negative aspects of urban expansion (urban sprawl or compactness)

In response to rapid urbanization, cities, planned or 'unplanned', have expanded significantly by sprawling or/and by 'compacting'. Thus urban planners have to face the problem that 'many cities are expanding at rates that exceed their capacity to accommodate the growing population' (WHO-UN Habitat 2016).

One form of urban expansion is by stretching the city's limits, a phenomenon known as urban sprawl. Residents of the sprawling parts of the cities might have different characteristics and needs. For example, they might be somewhat wealthy residents seeking more space in lower density areas; or comparatively poorer residents who seek more affordable housing at the periphery of the urban nucleus or constructing informal settlements at the fringe of the city, where there is usually a shortage or even absence of city services and insufficient infrastructure (WHO-UN Habitat 2016). The sprawling cities' problems include: less accessible necessities of everyday life (markets, healthcare facilities, schools, etc.) for many residents that become more car-dependent, especially private motor vehicles, driving longer distances, resulting in high energy consumption (WHO-UN Habitat 2016). Furthermore, health problems are directly linked to air pollution and traffic accidents, which, among other reasons, are also caused by the increase in numbers of private motor vehicles combined with the increase in the distances travelled, hence longer trip lengths, due to lower population density (Hanaki 2011).

A city, however, cannot only expand 'outwards' (sprawl), it can also expand 'inwards' by increasing urban compactness and the 'density' of the city, leading to urban crowding. This can lead to a limited housing supply, which, in turn, can lead to an increase in house/apartment prices and rents. As studies have shown (ODPM 2004) urban crowding can also be a cause of ill-health.

The priority for economic growth

According to UN-Habitat (2011) 'cities have become engines for economic growth, generating more than 80% of global economic activity'. By also taking into account the global economic competition of cities, it might be understandable that the qualitative needs of citizens and the environmental aspects of cities have been, in many instances, excluded from the planning and design priorities of the designers. In addition, according to WHO-UN-Habitat (2016) 'when people and their quality of life are not recognized as priorities, the consequences are likely to be at least unhealthy and at worst fatal'. These consequences usually include 'substandard housing, traffic-clogged streets, toxic air quality and underserved neighborhoods' (WHO-UN Habitat 2016). It is also understandable that often the areas of cities where people on low incomes dwell are mostly affected, and thus those people are further driven into poverty and despair (WHO-UN Habitat 2016). However, there seems to be a shift in the understanding of what economic growth and economic competitiveness means and how it should be implemented. For example, it is noted in the 2003-2004 Global Competitiveness Report of the World Economic Forum, that the Global Competitiveness Index is based on 'three central ideas', which seem to revolve around '"three pillars" … on which the process of economic growth rests': '… the macroeconomic environment, the quality of public institutions and technology' (Blanke et al 2004). However, we can see today in the 2017–2018 Global Competitiveness Report that among the 12 pillars 'that matter for productivity and long-term prosperity' on which the Global Competitiveness Index is based, is number four: health and primary education. Health and primary education are in fact also placed in

Fig. 2 Urban sprawl around Thessaloniki, Greece (Photo: Syrakoy AC).

the 'Basic Requirements' list of the Global Competitiveness Index (Schwab 2017). Nevertheless, the implementation of measures to support this fourth pillar seems slow and limited on a global scale.

From the above it becomes perhaps evident that even the few mentions of some of the causes of urban degradation (rapid and uncontrolled urbanization, negative aspects of urban expansion and priority on economic growth), present quite complex issues. Urban environmental proposals for solving some of them might seem truly burdened with rather difficult and sometimes even obscure tasks.

Conclusion

In terms of environmental urban design, guidelines and recommendations have existed throughout history. However, these design notions, theories and instructions seem to have been difficult to follow; their implementation, and especially their long term and continuous application, appears to be somewhat deficient and in many cases totally absent. Even today a similar pattern seems to exist but urban degradation still occurs.

Among the main causes of such phenomena are the rapid and uncontrolled urbanization, the negative aspects of urban expansion (urban sprawl or/and compactness) and the devastating priority on economic growth, which does not involve much consideration of the consequences for human health.

Indeed, it is not enough to know that there is a design for achieving a 'successful' environmentally designed urban area. Even if urban leaders, planners and designers anticipate each individual city problem, have a plan for achieving urban growth in a way that eases or prevents urban environmental degradation (and some of them actually do), it is not certain that they would/will succeed.

Some are trying to address this issue, such as, for example, in the field of Environmental Communication (see for example: Hansen and Cox 2015), which concerns, roughly speaking, the way we communicate en-

vironmental issues. Obviously this is a rather complex matter, but one that needs to be addressed, although it does raise some issues of its own. In particular, one issue concerning urban environmental design solutions, could be whether one such solution should integrate from its creation a relationship with the people that it is meant for, rather than resorting after its conception to communicative skills and means in order to implement the plan.

It is clear that it is not enough to just invent the most technically appropriate design solution for an environmental problem. It is also necessary to be able to successfully implement it, and this is often a completely different task. It is a task that needs to be vigorously addressed, otherwise our environmental solutions become an illusion, an unfulfilled 'promised land', one of many, lost in the realms of time as occurred in the past. The pain of being in a city is not related solely to the present situation, but more to the realization that it is highly likely that our environmental 'promised lands' will not be realized and, therefore, remain in our dreams…

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PROGRESS WITH MONITORING AND ASSESSMENT IN THE WFD IMPLEMENTATION IN FIVE EUROPEAN RIVER BASINS: SIGNIFICANT DIFFERENCES BUT SIMILAR PROBLEMS

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ABSTRACT

The river basin approach of the Water Framework Directive (WFD) and the introduction of ecological status represent a shift in the assessment and management of freshwater systems from discipline-specific to more holistic, catchment-based principles. At the core of the WFD's approach are catchments as highly interconnected systems. Despite strict timetables, progress towards achieving the WFD objectives has been slow, with deterioration in some cases not being halted. In this paper, looking at evidence from five European basins (Adige, Anglian, Ebro, Evrotas and Sava) we identify some of the key implementation challenges faced by each catchment during the development and implementation of the 1st River Basin Management Plans (RBMPs) of 2009. Despite significant differences in socio-ecological conditions, geographic coverage and starting points in the implementation between these river basins, findings highlight some similar key issues. The lack of a common systemic understanding of each river basin and detailed monitoring data to capture pressure-status interactions in order to anticipate how the system will react to interventions; as well as compliance driven implementation efforts were underlying problems in all five study areas. While some improvements to address these problems can be seen in the 2nd River Basin Management Planning Cycle (2015–2016), our findings demonstrate that a more effective approach is to question the deviation of the whole implementation from the directive's systemic nature and therefore improve the adaptive, collaborative, participatory and interdisciplinary nature of the implementation efforts.

Keywords: catchment management; ecosystem services; systems thinking; water framework directive

Introduction

The river basin approach of the Water Framework Directive (WFD) and the introduction of ecological status represent a shift in the assessment of freshwater systems from discipline-specific to more holistic, catchment-based principles. The Directive offered a tailored approach to improving water quality by conceptualizing and managing catchments as highly interconnected systems. It sets specific procedural obligations for its implementation by Member States aiming at the coordinated and harmonized transposition of the Integrated River Basin Management paradigm as the process for delivering good ecological status. Its approach was characterized as innovative, ambitious and revolutionary, which accounts for the great expectations that came with the WFD, leading to it being considered as a potential template and basis for future environmental regulations (Josefsson 2012).

However, the monitoring and assessment of European waters under the WFD required a new mind-set and a new procedure, which most Member States found challenging to implement. Fifteen years after the Directive was introduced, and with many problems and delays in its implementation, progress towards achieving WFD objectives has been slow with deterioration in some cases not being halted (European Commission 2015a).

This article examines implementation practices in five European river basins during the 1st WFD management cycle (2009–2015) in order to identify some of the key challenges of monitoring and assessment. It investigates the deviation of practices at the catchment level from the WFD's aspirations in order to highlight important lessons that could help future implementation. Also by looking into early reports on the development of the 2015 River Basin Management Plans (RBMPs) for the 2nd planning cycle this article evaluates whether the Member States have learnt from the lessons of the 1st cycle.

Materials and Methods

Based on data obtained from: EU directives, European Commission policy documents (Implementation Reports and various technical reports), scientific journals, grey literature, EU and national research projects and RBMPs, an extensive policy analysis was undertaken for this study. This work reviews how the procedures outlined in the WFD were interpreted and applied at the catchment scale by focusing on the monitoring and assessment of water body status as required by the Directive.

The process of monitoring and assessment of water body status under the WFD

River Basin Management (RBM) planning under the WFD begins with the competent authorities and all relevant parties defining the system of interest (river basin) and developing a robust understanding of its characteristics and conditions. The characterization of the river basin is a stepwise process that includes four main ele-

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ments; characterization of water bodies, typologies, reference conditions and pressure-impact analysis (Fig. 1). The WFD introduced multi-objective monitoring, consisting of three types: surveillance, operational and investigative, as specified in Annex V (European Communities 2003a). The process of assessing ecological status is based on several elements that aim to indicate the deviation of the system from its state under undisturbed/reference conditions (Fig. 1). The resultant classification follows a one out-all out scheme at the level of the quality elements, meaning that a water body cannot be assigned a good ecological status if any element has a value that deviates moderately or significantly from those normally associated with undisturbed conditions (European Communities 2005).

The selected basins

The selected basins encompass a rich set of socio-ecological conditions and wide geographic coverage. These are: Ebro in Spain and Evrotas in Greece (both in the Mediterranean), Sava, (which is a continental and trans-boundary, shared between Slovenia, Croatia, Bosnia and Herzegovina and Serbia), Adige in Italy (an Alpine basin) and Anglian in the UK. Each case study has its own water management history and thus, any comparisons between them need to be based on a clear understanding of the characteristics and context of each case study. This article focuses solely on the implementation of WFD monitoring and assessment requirements, and reviews progress in each catchment since the WFD was adopted. For this, the key characteristics of the pre-WFD water management regime at each catchment are summarized in Table 1.

Common Implementation Challenges (1st cycle of RBMPs)

Discrepancies in characterization, including the delineation of water bodies, typology and reference conditions, were identified to different degrees in all five river basins. In the Evrotas and Sava the reference conditions were not established in time while in the Ebro River Basin District (RBD) the reference conditions were reported to be incoherent (European Commission 2015a; European Commission 2015b; ISRBC 2013a). In Adige and Anglian RBDs, no biological information for the different types surface water was provided (European Commission 2012a; European Commission 2012b). Also, in the Ebro RBD a lack of coherence in the typology has affected the process of determining the status or setting environmental objectives for transitional and coastal water bodies (European Commission 2015b). Furthermore, in the Anglian RBD, Ebro RBD and Sava RBD, there has been a need to revise and improve the designation of heavily modified and artificial water bodies (Environ-

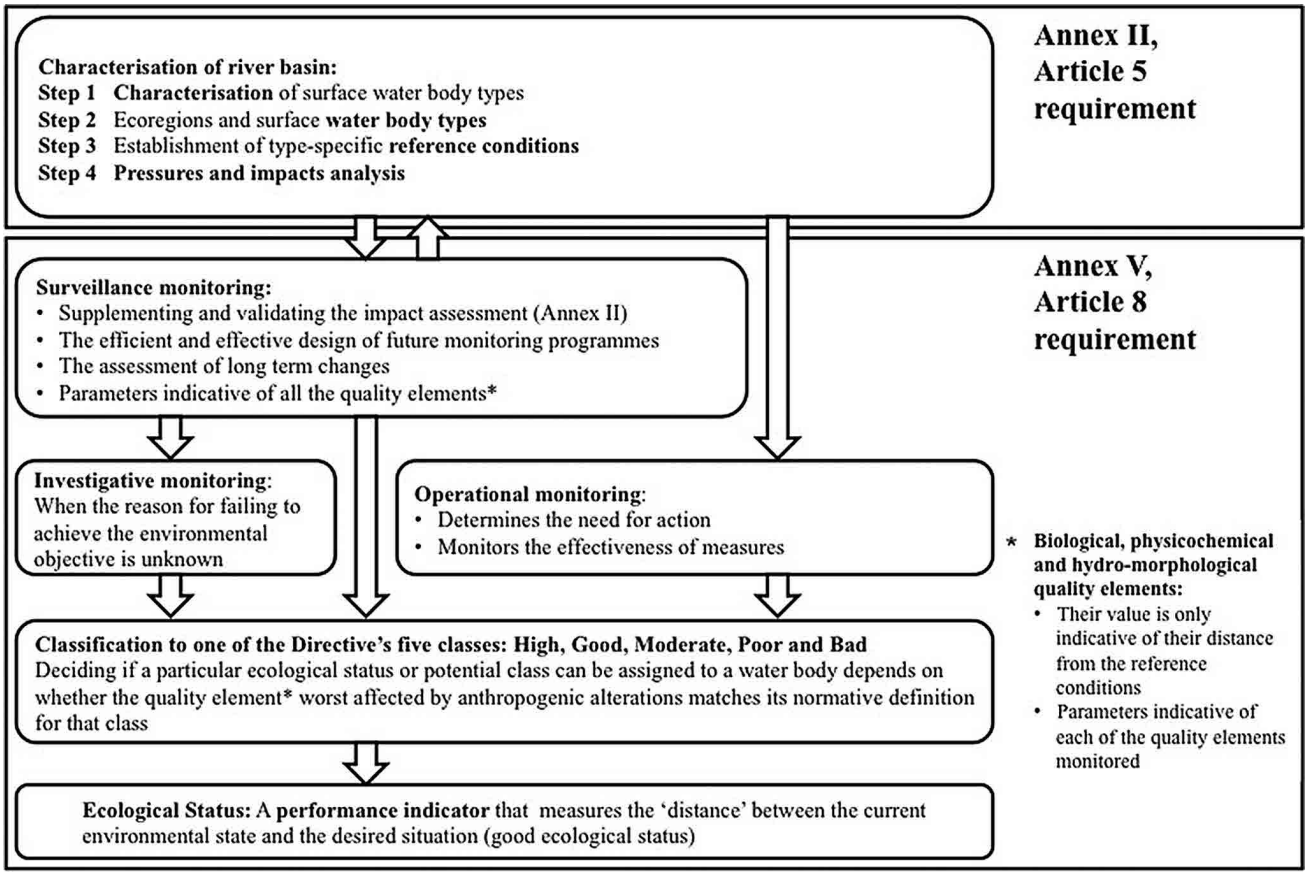

Fig. 1 The procedures for monitoring and assessing under the WFD.

Table 1 The key characteristics of the pre-WFD water management regime in the selected basins.

Basins	Structures and administrative arrangements	Monitoring infrastructure and assessment
Adige (Italy)	– The National Environmental Protection Agency established in 1994 – Water basin authorities (Goria and Lugaresi 2004) develop and apply the River Basin Management Plan – This plan includes four transitional plans: i) the transitional plan for the restoration of hydraulic structures; ii) the transitional plan for the hydro-geological Settlement, also containing the transitional plan for fluvial areas; iii) the special plan for areas with high hydro-geological risks; iv) the transitional plan for the control of eutrophication (Balzarolo et al. 2011).	– Monitoring of programs was undertaken at the local level, on a case-by-case basis. – The range and extent of programs may vary but local monitoring can be divided into: trend detection and general quality characterization, assessment of the effects of discharges and point pollution incidents (Lawson 2005).
Anglian (UK)	– Regional Water authorities established in 1974 were determined by the river basin areas (Medd and Marvin, 2007). However, they were disassembled in 1987 in favor of the National Rivers Authority, which kept the regional management structure and geographical boundaries – The Environmental Act in 1995 established the Environment Agency. The new management regime was organized on a regional basis being a combination of river basins and administrative boundaries (Chave 2001).	– Since 1970, General Quality Assessment consisted of monthly spot monitoring of the chemical components, dissolved oxygen, biochemical oxygen demand and ammonical nitrogen, and the nutrients phosphate and nitrogen, in stretches of water with a flow greater than 1 m^3/s. – Biological Monitoring Working Party scoring, has been used since the 1980s – In 1994 the Fish Identification Scheme was implemented – In 1995 the development of the Surface Water Abstraction Licence Procedure was developed. – River Invertebrate Prediction and Classification System (RIVPCS). – The river habitat survey was developed in order to assess the physical structure of rivers.
Ebro (Spain)	– The Ebro river basin has had a specific water agency for water management since 1926, the Ebro Hydrographic Confederation, but with overlapping institutions and agents that make the actual management more complex (Bielsa and Cazcarro 2015).	– Different types of monitoring networks – Monitoring of the quality and quantity of ground water but quite differently from that required by the WFD. – Abstraction data were not accurate enough. – Lack of biological data – Heterogeneity of data sources and data.
Evrotas (Greece)	– Decisions concerning national water planning were taken by different central governmental agencies, or at the local level, by the responsible municipal authorities, while local/regional social actors were totally excluded (Demetropoulou et al. 2010).	– Poor technical infrastructure. – Lack of a unified network in the Country, various networks existed managed by various agencies and for various purposes. – Inadequate and unreliable field data (Alexopoulou et al. 2005).
Sava (Slovenia, Croatia, Bosnia and Herzegovina and Serbia)	– The decay of the former Yugoslavia (1990s) challenged water management, because the Sava river from the being the largest river in Yugoslavia became an international river flowing through several countries (Komatina and Groselj 2014) – Republic level authorities in Slovenia and Croatia (Čolakhodžić et al. 2014). – In Serbia Public Water Management Company "Serbia Waters" was created in 1996 to implement the water management activities (UN 2004). – Bosnia and Herzegovina, is a relatively new post-war democracy, and thus new structures had to be established.	– Monitoring activities differed in the different countries and was generally limited to certain river sections, or to particular variables, and datasets that are not entirely comparable.

ment Agency 2009; European Commission 2012b; ISRBC 2013b; Environment Agency 2015).

The pressures and impacts analysis and its implications for the identification of the significant pressures that need to be monitored, seem to be the greatest issue in all basins. In the Ebro RBD there seems to be a mismatch between the pressures in the catchment and the ones' reported. Although, water quantity has been a significant problem, there are relatively few water bodies identified as being significantly affected by water abstraction. This could be attributed to the fact that Spain reports only the results of a qualitative pressure and impact assessment to the Water Information System for Europe, which is not accurate in case of water abstraction (European Commission 2015b). Similarly, and despite the large number of dams and river infrastructure existing at Ebro, relatively few water bodies (<20%) are reported to be significantly affected by the results of water flow regulations and hydro-morphological alterations (European Commission 2015b). Although the Directive requires the pressure and impacts analysis to be a continuous process validated and supplemented by monitoring, generally in Spanish catchments the final and complete assessment of pressures and impacts was wrongly seen as a one-off exercise, which was due only in 2005 as part of the preparation of the 1st RBMPs.

Current assessment schemes mainly focus on more traditional pressures (e.g. eutrophication, organic pollution) (Hering et al. 2010) neglecting other pressures that have more recently come into focus. One of which includes the implications of climate change in water management. As an example, there are issues identified with regards to the effect of climate change associated with the release of chemical pollutants from snow and glacier melting, an occurrence that has not yet been fully investigated in the case of the Adige basin (Chiogna et al. 2016). Similarly, the Ebro RBMPs states that, in the absence of evaluations of the climate scenario prepared by the Ministry of the Environment, a rigid percentage (5%) in the global reduction of natural contributions must be applied, but this plan ignores current research findings for which that reduction for 2050 is expected to be in the range 15%–35% (Bielsa and Cazcarro 2015). This raises another question from a managers' perspective with regards to the reliability of the thresholds of significance used for the pressure inventories. This is apparent in the cases of the Evrotas basin and Sava RBD where the criteria for identification of significant pressures haven't been catchment specific (Central Water Agency 2006; ISRBC 2013a). Although this practice provides an initial starting point and baseline for the pressure and impact analysis, using one set of thresholds across Europe is not ideal since this fails to recognize the particular characteristics of the water body and its vulnerability to pressures (European Communities 2003b). The Anglian RBD is a better example of the application of the pressure assessment. A preliminary analysis of the pressures and impacts revealed some issues including the identification of the effects of hydro-morphological pressures on the ecological status, the limitations of the traditional General Quality Assessment to represent effect data as well as the challenges in understanding the relationship of the link drivers to the pressures (DEFRA 2005).

The problem of identifying significant pressures affects the classification of statuses and this has been another source of error identified in all the basins. For example, although the assessment of pressure effects in the Ebro RBD has identified 77% of the water bodies (635 water bodies) as not affected, however, when compared to the number of good status water bodies in 2009 (226 water bodies) the number of good status surface water bodies is much less than the number of water bodies not affected (European Commission 2015b). Another illuminating example comes from the Croatian part of the Sava RBD. Although, Biological Quality Elements (BQEs) in operational monitoring were chosen in relation to existing pressures, there is no clear evidence to show which BQEs were selected to monitor the significant pressures. The RBMP of Croatia also reports that operational monitoring was only carried out in relation to point source pressures, not diffuse sources.

Another important challenge in implementing operational monitoring and delivering reliable classifications is the lack of well-established methods of assessment for all BQEs. For Adige, Ebro, Evrotas and Sava the methods for assessing ecological status were not developed for all BQEs specified in the WFD and as a result not all BQEs were monitored. Although this could be a one-off problem, there are cases where this has compromised the selection of the most appropriate indicators of significant pressures. In the Evrotas basin the classification of rivers as far as BQSs is concerned was based on monitoring of benthic invertebrates and fish (fish were not included in the Evrotas tributaries) since for the macro algae and phytobenthos it was not feasible to determine the class boundary limits (Nikolaidis et al. 2009). In the Anglian RBD, despite having one of the most intensive monitoring networks, not all of the relevant quality elements are monitored. Although all relevant BQEs were used in operational monitoring, not all supporting elements were. For example, there was no monitoring of river continuity, tidal regime in coastal waters or fish in lakes (European Commission 2012b). In addition, 54% of water bodies were monitored for at least one biological element, scoring the lowest among the other catchments within England and Wales (Collins et al. 2012). More severe gaps in elements monitored are present in the case of the Sava trans-boundary catchment, potentially due to differing levels of the WFD implementation among the countries involved. For example, while in Slovenia operational monitoring covers most of the relevant quality elements, in Croatia the preliminary assessment of the ecological status was made using only physico-chemical and hydro-morphological quality elements (European Commission 2015c). In Serbia the monitoring and assessment of the ecological and chemical status for the Sava RBMP is not fully compliant with the requirements of WFD, while in Bosnia and Herzegovina they were not implemented (ISRBC 2013a).

Lessons from the 1st RBM Planning Cycle and Signs of Progress

The problems in implementing the procedures outlined in the RBM planning has knock on effects on the subsequent steps and reduces the reliability of their outputs. In Anglian, the 2nd cycle brought improvements, making the characterization of surface water systems more ecologically relevant by changing water body boundaries and designating coastal and transitional types. In Ebro there was no update of the designation process of heavily modified water bodies and the definition of good ecological potential, while in Sava RBD there was a lack of harmonization of trans-boundary water bodies. However, in all three case studies there was good progress with the definition of reference conditions for certain biological quality elements. (Environment Agency 2015; European Commission 2015d; ISRBC 2016).

The assessment of pressures and impacts is an on-going process within RBM planning, which should be kept

up to date to enable timely, appropriate and effective water management (European Communities 2003b). In Ebro however, there is still no review of the legislation for explicitly incorporating the identification of water bodies at risk identified by the pressures and impacts analysis and there are no clear criteria for defining significant adverse effects (European Commission 2015d). In Sava, the risk assessment was implemented in terms of ongoing pressures (organic, hazardous substances and nutrient pollution and hydro-morphological alteration) and their future development but the risk to over 26% of Sava water bodies and 50% of its tributaries is unknown (ISRBC 2016). In Anglian, the risk assessments have been improved and the outputs were utilized in the design of the monitoring networks (Environment Agency 2015).

The validation of the pressure and impacts analysis using surveillance-monitoring data is especially important in the context of multiple pressure interactions. As freshwater systems are influenced by pressures whose effects are relevant at multiple spatial and temporal scales, the thresholds of significance for example of a certain pollutant may change based on the specific characteristics of the catchment. For example, even low levels of contamination may become relevant for the ecosystem when it is subject to additional hydrological stressors. The identification of 'significant' pressures may still prove difficult, if the combined effects of non-significant pressures are neglected. Complex synergistic or antagonistic interactions between multiple pressures are very common (Piggott et al. 2015) and therefore one of the largest sources of uncertainty when predicting ecological change. A recent study (Chiogna et al. 2016) in the Alpine catchment of Adige showed how unpredictable the effects of such pressure interactions can be. According to the classification data collected by the relevant authorities, the highest quality values were recorded in the upstream regions compared to those downstream where the ecological status deteriorated. Such a north-south gradient in ecological status recorded at the monitoring points along the Adige seems to contradict the evidence that hydropeaking generally has a negative effect on the ecosystem as the data demonstrate that the worst ecological status is recorded where the effects of hydropeaking are negligible (Chiogna et al. 2016).

Operational monitoring should focus on parameters indicative of quality elements most sensitive to the pressures affecting the status of a water body (European Communities 2003a). Apart from the pressure and impact analysis, which identifies significant pressures, the reliability of the overall classification of ecological status, depends on the existence of appropriate methods for assessing the relevant BQEs. In the Anglian RBD a new monitoring network was introduced in 2013 and 2014 with a better coverage of BQEs. The methods for assessing surface and ground water status were improved by including: new standards for additional chemical substances, updated standards for existing physico-chemical elements and improvements in biological assessment tools, although fish in lakes are still not being assessed (Environment Agency 2015). In Ebro, there has also been some progress with new protocols and indicators added to monitoring (European Commission 2015d). However, there are still gaps in monitoring coastal and transitional waters and in the assessment of ground water quantitative status. The status of 33% of lake and river water bodies has still not been assessed. Regarding, the Sava RBD, Slovenia and Croatia have now established monitoring programs in line with the principles of the WFD, while the other Sava countries are still in the development phase (ISRBC 2016).

Discussion and Conclusion

This paper aimed to provide insights into the complexities and challenges of the monitoring and assessment required by the WFD by presenting examples of implementation problems in five European river basins; Adige, Anglian, Ebro, Evrotas and Sava. Despite their differences, the main implementation challenges are similar in all basins: the lack of a common systemic understanding of each river basin; absence of detailed monitoring data on pressure-status interactions in order to anticipate how the system will react to interventions and overall compliance driven implementation efforts.

Although this has been attributed to the resistance and unwillingness to change from usual practices (Hering et al. 2010), misunderstandings of some of the Directive's innovations such as the role of ecological status as a performance indicator of the health of a system have also potentially contributed (Voulvoulis et al. 2017). Early signs of progress seen in the 2nd RBM planning cycle were mainly procedural, with no clear evidence that these misunderstandings have been resolved.

Member States continue to focus implementation efforts on how to meet the Directive's procedural requirements without appreciating, if not, understanding the Directive's new approach. Compliance driven implementation for example in the UK, was criticized as "implementation turned into a "tick list" of compliance, for small water bodies, against some 50 sets of standards" (Everard 2012). Assessment and management focus on the parts rather than overall ecosystem health, and without addressing their interactions, in contrast to the aspirations of the inherently systematic WFD. The WFD's ecosystems approach for the assessment of surface water system health and the introduction of ecological status represents a shift from disciple specific approaches towards holistic resource performance assessments, which requires an interdisciplinary mind-set. Traditional silo-based management rooted in disciplinary thinking often provides an incomplete representation of the entire environmental system (Jones et al. 2011). In principle, the Directive encourages research,

involving social and natural scientists and engineers, on understanding changes in water systems and their interactions with human activities (Hodgson and Smith 2007). Therefore by integrating multiple perspectives in the decision-making process the WFD seeks a robust understanding of the issues and interactions within the catchment (Collins et al. 2007).

The use of "all available" knowledge was intended to encourage public participation in the WFD and yet, the knowledge of local people is not generally used by most scientists and authorities (Valinia et al. 2012). River basin characterizations, including the risk assessments in the case studies, focus only on technical considerations, which are often unclear to the public, water users and stakeholders. Instead, stakeholder views should be included in the conceptual models that should be examined by other stakeholders while technical experts should aim to facilitate the needs and views of these participants (Hart et al. 2006). The fact that the concept of "desired state" by definition requires multiple perspectives, ecosystem health does not equate simply either to biotic integrity or to habitat quality and thus defining health cannot be primarily rooted in one scientific discipline or in one particular aspect (e.g. a single group of taxa) (Fairweather 1999). The way good status has been understood and approached neglects the interdisciplinary nature of ecosystem health if engaging with stakeholders by means of a catchment participatory process does not take place. Identifying community aspirations for each water body is critical. The Directive requires involving the public, water users and stakeholders at an early stage (Article 14 of the WFD) and through all management steps, including the setting of reference condition as is stressed in Guidance Document No. 8 (European Communities 2003c). As the guidance documents are not legally binding for the Member States, public participation has been heavily dependent on the political will of the relevant authorities.

Making the WFD's systemic integration of multiple perspectives operational has a long way to go, with some evidence of a transition towards an adoption of the ecosystems approach by integrating Ecosystem Services in the implementation process (Voulvoulis et al. 2017). Even though Ecosystem Services are not explicit in the wording of the WFD, there is a clear connection between the Directive and their delivery (Vlachopoulou et al. 2014). Investigating further the relationship between environmental 'state' and 'effects' on the quality elements monitored under the WFD and how they link to the provision of Ecosystem Services could enable greater involvement by the stakeholders in defining the desired state of the freshwater system. Adopting the Ecosystem Services language; a participatory approach for the assessment under the WFD could be facilitated, by translating how changes in water quality status reflects changes in those services and goods they value. The stakeholders could provide a more robust definition of good ecological status based on what they value. Using Ecosystem Services as the proxy of those natural elements of water systems that are ultimately valued by our society, its integration in decision making by explicitly identifying the interdependencies of how human activities within the catchment influence their provision (Asah et al. 2014) could support the implementation of the monitoring and assessment under the WFD.

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POTENTIAL FOR DEVELOPING TOURISM IN A SUB-REGIONAL GROWTH AREA (ROXAS-DUMARAN-TAYTAY) IN NORTHERN MAINLAND PALAWAN

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ABSTRACT

The majority of the tourism industry on mainland Palawan is located in the north of the province. El Nido and Puerto Princesa are the most visited tourist areas in Palawan. The municipalities between these areas are considered to be sub-regional growth areas (Roxas, Dumaran and Taytay) since they serve as transition areas from one tourist hot spot to another. This study explores the tourism potentials of the sub-regional groregionwth areas using a potential analysis. By exploring the cases of Roxas, Dumaran and Taytay, various potentials were identified that could contribute to the development of this region of the island. Characterization resulted in the identification of the competitive advantages of each municipality, which were used to develop this region in a way that assures a sustainable growth of this sub-region that complements that occurring in the tourist hot spots.

Keywords: potentials analysis; tourism development; tourism growth poles; tourism spatial strategy

Introduction

Palawan is the largest province in the Philippines, with a total land area of 1,703,705 hectares comprised of 1,708 islands and islets. It is dubbed as the "Last Ecological Frontier" in this country because of its unique and diverse flora and fauna (Sandalo and Baltazar 1997). Furthermore, this province is subdivided into three areas: northern Palawan, where the production of agricultural crops and tourism are important; southern Palawan, where agribusiness is most important; and in the middle is the lone city of Puerto Princesa, where most of the thriving industries (e.g. malls, call centres, factories, etc.) are located.

Palawan is one of the island provinces in the Philippines, where tourism and agriculture are important features of the economy. Based on data from the Palawan Tourism Promotions and Development Office (PTPDO), a total of 870, 478 tourists visited the area in 2013, which is 67.48% (587, 441) greater than in 2008. The majority of the tourism industries in Palawan are located in the northern part of the province in which the municipality of El Nido and Puerto Princesa city are situated. In the 2013 the ranking of Puerto Princesa City and the municipality of El Nido were, respectively, first and third of the most visited sites in Palawan (Salcedo 2015). These municipalities offer different tourism-related activities, such as accommodation, leisure, food, tours and sightseeing.

Due to that fact, this city and municipality are the primary tourist hot spots based on the growth pole theory formulated by Francois Perroux in the early 1950s, which emphasizes in particular the importance that economic growth in a region should be linked with a key industry that has interconnections with different industrial activities and affects the area by promoting economic development (e.g. increase in employment, high labor force, expansion of existing industries, etc.) (Wheeler et al. 1998). Based on this theory, the city of Puerto Princesa and municipality of El Nido were identified as growth center's since based on various planning documents such as the National Tourism Strategy of the Philippines, Regional Development Plan and Provincial Physical Framework Plan of Palawan, include these municipalities in the primary tourism hot spots.

Furthermore, a study was conducted at Coron and Busuanga, another part of the province, where new tourist areas were developed to complement the growth of the primary tourist hot spots. These tourist areas are expected to gradually develop their own market and attract more visitors into the region (Tomeldan 2009).

However, the presence of tourism hot spots also connotes disparity through the phenomenon called polarization in which the majority of the economic activity occurs in the center of the region resulting in regional disparity (Balisacan 2006). In the case of northern mainland Palawan, the municipalities of Roxas, Dumaran and Taytay are sub-regional areas. They are characterized by having a lower capacity for development than the tourist hot spots, in lacking an urban center, a need to improve transport and infrastructural facilities and diversify the local economy by utilizing the rich and varied environmental assets of the rural settlements (Government Office for the East Midlands 2005).

This study focuses on the identification and classification of the potentials for developing tourism in the municipalities of Roxas, Dumaran and Taytay as part of the established tourism hot spots. The development of tour-

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ism in the sub-regional growth area (Roxas, Dumaran and Taytay) needs to be based on strategies that complement the development of tourism on the northern mainland, Palawan. This could result in more even growth in tourism in the province.

Methodology

This study included four municipalities and a city. At this scale it can be achieved by utilizing the primary and secondary data available (Johnston 2014) in different local government offices in each municipality and city and from the databases of provincial and national governments. The secondary data gathered was validated by a Key Informant Interviews (KII).

In terms of role clarification and assignment for the sub-regional area of growth, identifying its competitive advantages relative to those of the tourist hot spots sets the baseline for the competitive advantage of the tourist hot spots. The criteria for the identification were based on the Comprehensive Land Use Plan (CLUP) of the Housing and Land Use Regulatory Board (HLURB) in the Philippines (Table 1).

These success factors emphasize the importance of competitive indicators such as natural environment, infrastructure, social services, etc., which affect the survival of the industry in the market (Thompson et al. 2012). By doing so, the ability of the sub-region to produce a unique industry that has the potential to become a regional development was highlighted. In addition, determination of strengths and weaknesses as assets of the sub-region unveils different potentials that contribute to the determination of competitive advantage (Blackwell and Eppler 2014).

Such data were combined and used in a tool called Potentials analysis. Potentials analysis is a planning and decision making tool that allows the creative and self-reflective analysis of the actual (already developed) and latent (existing but yet to be developed) resources within an area or community under study. This determines various potentials of a certain region resulting in a context based planning that is not dependent on external sources. This tool, utilizes different characteristics of an area,

Table 1 Criteria for evaluating tourism competitiveness (HLURB, 2014).

Group heading	Criteria	Weight	Considerations
Lodging and Food	Lodging facilities	12%	Hotels, inns, resorts, private homes
	Food facilities	6%	Restaurants, drive in inns
Recreation and Shopping	Shopping facilities	3%	Handicraft stores, gift shops, department stores
	Night time recreation	2%	Nightclubs, discotheques, theatres, cinema
	Facilities conducive of health and relaxation	2%	Hot springs, mineral water springs, picnic grounds, hiking trails, parks
	Education facilities	2%	Zoos, botanical gardens, aquariums, museums
	Sports facilities	2%	Hunting, fishing, scuba diving, swimming, golf, Tennis, Pelotas, horseback riding
Infrastructure and Utilities	Accessibility	6%	Highways, roads, airports, bridges, piers
	Transportation facilities	6%	Land, sea, air facilities
	Communication facilities	4%	Radio, TV, telephone, Telegram
Natural factors	Natural beauty	15%	General topography of the area, flora and fauna, lakes and river, sea, island, springs, waterfalls
	Climate	5%	Amount of sunshine, temperature, fresh air
Peace and order	Security for tourists	10%	
Social and Cultural factors	Artistic and architectural features	2%	Local architecture – mosques, monuments, old buildings, forts
	Festivals	4%	Religious, sports, music/dance festivals
	Distinctively local	2%	Folk dances, costumes, music, souvenirs
	Fairs and exhibits	2%	Commercial/non-commercial
	Attitude towards tourists	2%	Local congeniality and treatment of tourists
Historical	Ruins	4%	Condition and accessibility
	Monuments, memorials, religious and historical landmarks	4%	The extent to which a site may be well known due to important historical events
Rating: Score in terms of points Descriptive Rating 91–100 3.1–4 Excellent 80–90 2.1–3 Very Satisfactory 66–79 1.1–2 Satisfactory 65–below 0.1–1 Unsatisfactory			

such as existing human resources and infrastructure to reveal the different potentials of a region.

Application for development in tourism is new and limited to unpublished manuscripts, however, this tool is widely used as it can elicit endogenous landscape characters that can be directly tapped and used to achieve the local or regional goals. Such purposes were similarly applied to the identified sub-regional growth centers in Northern Mainland Palawan. Consisting of simple potentials (e.g. mountains, rivers, etc.), this could become a more complex idea by combining two simple potentials that could result in first level potentials (e.g. mountain + river as source of water = timber production), and combining a simple potential with a first level potential could result in a second level potential (e.g. humans as workers + timber production = timber exportation). After this, the results from the first level potential and second level potential can be combined and analyzed in order to formulate a potential tourism development strategy for certain sub-regional growth areas. This resulted in the development of unique potentials that could be used to enhance regional development. Below is the step-by-step process for formulating a tourism development strategy using potentials analysis (Fig. 1).

Results and Discussion

Analyzing the existing roles of the sub-regional growth area (Roxas-Dumaran-Taytay)

The identified growth poles with the characters of Francois Perroux growth poles of 1988 indicate that a propulsive industry in one location can encourage growth outward from that location. Such industry, which in this case is tourism on the Northern-Mainland, Palawan. The thriving tourism in the area is generally coupled with a concentration of population and centralization of economic activities and services. The following are the observable characteristics of both the growth poles and growth centers in the regional analysis.

Population character

The an annual population growth rate of 4.51% and 3.32%, for Puerto Princesa city and El Nido, respectively, clearly indicates that these municipalities are the growth centres in northern mainland Palawan, where the majority of the economic activity, especially tourism and other industries, are situated (Table 2). Unlike Roxas (2.59%) and Dumaran (2.67%), Taytay has a higher growth rate (3.10%) because this municipality has more established

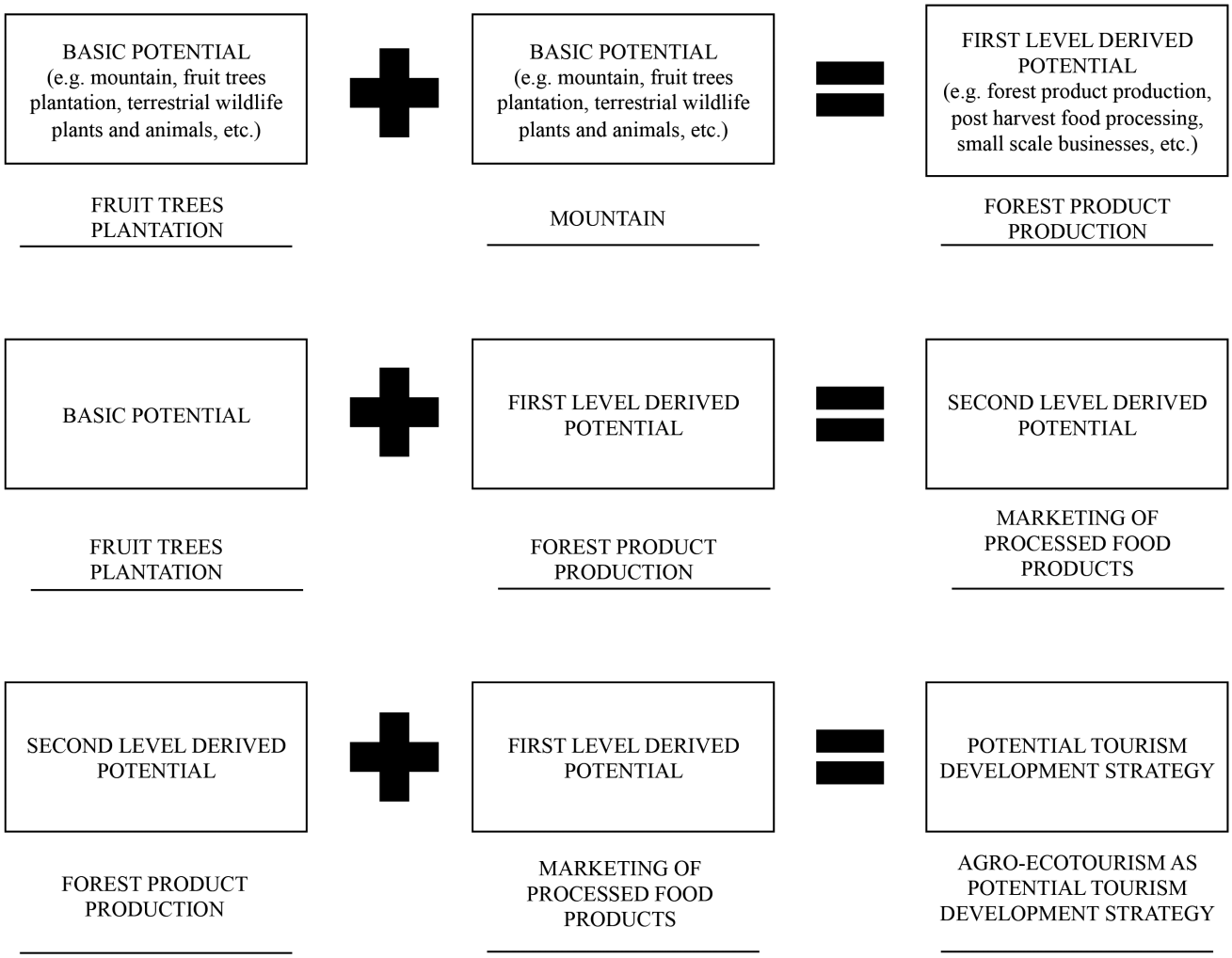

Fig. 1 Step-by-step process of Potentials analysis.

Table 2 Historical population growth in the sub-regional growth area and tourism growth poles.

Municipality	Population					Average Annual Growth Rate
	1990	1995	2000	2005	2010	
Roxas	36,604	44,370	47, 242	51,084	61,058	2.59%
Dumaran	12,624	13,980	16, 616	18,737	21,397	2.67%
Taytay	38,435	47,095	53,657	61,991	70,837	3.10%
El Nido	18,832	21,948	27,029	30,249	36,191	3.32%
Puerto Princesa	92,147	129,577	161,912	210,508	222,673	4.51%

economic characteristics as it was once the provincial capital of Palawan. Clearly, the population growth over the last two decades (1990s) in El Nido and Puerto Princesa has been higher and coincides with when tourism became important in Palawan.

Population density

Population distribution in the municipalities in this sub-regional growth area indicates that there are a few places where the population is dense enough to affect the level of productivity (Parr 1999). Taytay has a total population density of 55 persons/km^2 and the largest land area (1,265.24 km^2), and a total population of 70,837, followed by Roxas with a population density of 49 persons/km^2 in an area of 1,225.50 km^2. Comparatively, there is only a slight difference between the characteristics of Roxas and Taytay. Lastly, Dumaran has the lowest population density of the municipalities with a total of 38 persons/km^2, which is lower than Roxas and Taytay, but its land area of 553.27 km^2 is considerably less and as a consequence the population density there is much higher than in the other two municipalities (Dacumos 2015).

Socio-economic character

Puerto Princesa city and El Nido have higher annual population growth rates than that of the sub-region, which is a result of the agglomeration there of economies. This leads to the availability of social services geared towards accommodating the larger population and the influx of tourists. Also, being the centre of tourism (Puerto Princesa city and El Nido), the economic investment increases, which further increases the density of the population (Syez 2013). For instance, records of unemployment in Roxas and Taytay in 2010 are 56.97% and 73.28%, respectively (SEP 2010), which are very high.

Spatial stratification

Based on the Provincial Development and Physical Framework Plan (HLURB 2014), municipalities in this sub-region are designated as agriculture – based economies, which produce major crops, livestock, poultry and fisheries. On the other hand, given the potential for an agriculture-based economy, the majority of the growth is in tourism and urban development. This is an example of spatial discrimination in which the potential role of a certain region is overridden by economic activity (Parr 1999).

Market orientation

Agricultural production of this sub-region mainly goes to centres of tourism in the province. Roxas' and Dumaran's cashew production goes directly to Puerto Princesa and is used to produce the booming cashew souvenir goods. Dumaran's livestock and Taytay's fish products, respectively, go mainly to hotels and restaurants in Puerto Princesa. This is also true of some High-Value Commercial Crops (HVCCs) and other vegetables produced only for the tourism industry.

These municipalities, by virtue of the growth pole strategy, are inevitable recipients of the "spillover" economic benefits (and possible negative effects) and services found in the growth centres since they have the services and investments for further development.

Implications of the tourism growth poles

The Spread and associated effects, as outlined by economists Myrdal and Hirschman,are among the general categories predicted by the growth pole theory. In the simplest sense, the spread effects are the positive effects of urban proximity for communities, and associated effects are the negative consequences of proximity. Several studies have revealed a variety of results if this theory is used as a guiding principle in explaining certain economic phenomena in the region.

Provided with such conditions, the northern mainland Palawan region was analyzed using the spread and associated effects predicted by the growth pole theory. In summary, the spread and associated effects can be measured by either a change in population or change in income as a function of distance to the nearest city (Ganning, n.d). Results show similarities in the effects of tourism growth poles in the region of Northern Mainland Palawan.

Vibrant generation of employment in the growth poles

Man-power coming from the sub region is employed in Puerto Princesa. Benefits from manual labour do not go to the municipality but the growth poles, as the demand is there. As for the case of Dumaran, all the vocational school graduates funded by the national government are employed in either Puerto Princesa or El Nido. Business and industry struggle to survive because they lack effective manpower, financial resources and

investment, which mainly go to the more profitable areas (Puerto Princesa and El Nido), this unfavorable socio-economic context may also determine the level of entrepreneurship in an area (Chouinard et al. 2002).

Population composition

Employment associated with tourism attracts much of the local population to the growth poles and they also choose to reside near their place of work. Other aspects of this sub-regional population migration account for the services that only Puerto Princesa provides.

Agricultural productivity

Attraction is evident since the growth poles offer a larger market. Also, some areas in the sub-region, especially Dumaran, are the exclusive supplier of livestock and vegetables for Puerto Princesa for their booming tourism industry, even if there is a demand for similar products in the same municipality. Agriculture is important in Dumaran, Roxas and Taytay, accounting for 70%, 70% and 72.36% of their economies, respectively (SEP 2010). This implies a strong dependence of the sub-regions on agriculture. In addition, the agricultural produce of the sub-region are raw materials devoid of added value, from which Puerto Princesa mainly profits.

Poverty threshold

The incidence of poverty is high in the sub-regional growth area because tourism attracts industries to northern mainland Palawan, which attracts workers. These movements of people are further stimulated by privatization and deregulation of public areas such as islands, forestland and agricultural land, which among other factors have considerably reduced the number of jobs for the locals (Gant 2006). The majority (68.07%) of the households in the sub-regional growth area classified as *below poverty threshold,* with a total number of 29,918 (ERMP 2015). Taytay has the highest percentage of households in this classification with 13,264 (76.54%), followed by Roxas with 12,993 (66.49%) and Dumaran with 3,661 (43.02%). In addition, there are a great number of households classified as below the food threshold level in Taytay, Roxas and Dumaran, with 60.87%, 52.69% and 27.40%, respectively.

Critical disruption of ecosystem

In the case of the sub-regional growth area, there is a conflict between environmental conservation and economic development. Resources from the marine ecosystem, such as fish are decreasing, in particular coral reefs in Dumaran are no longer highly productive due to over fishing, privately owned pearl farms limiting the access to coastal waters, the conversion of mangrove and forest lands to residential areas and the unsustainable practice of the *Kaingin system* (slash and burn), which is evident particularly in Taytay and Dumaran. These activities are centered mostly on producing goods for the growth centers.

Competitive advantage of tourism in the sub-regional growth area

The figures in Table 3 provide an assessment of the competitive advantage of tourism in the sub-regional growth area (Roxas-Dumaran-Taytay). This is based on the capability of each sub-regional center to attract tourists to their area. Overall, of the three centers Taytay has the highest rating for tourism competitiveness although

Table 3 Researcher's evaluation of the tourism competitiveness in the sub-regional growth area.

Municipality	Weight																				Total	Rating*
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T		
Roxas	10	5	3	2	1	1	2	5	4	4	15	5	10	0	4	2	0	2	0	0	75	VS
Dumaran	5	3	1	1	1	1	0	3	4	3	15	5	10	2	4	0	0	2	4	4	68	US
Taytay	12	6	3	2	2	2	2	5	6	4	15	5	10	2	4	1	0	2	4	4	91	E

The scoring for the municipalities are based on the data gathered by the researcher and secondary data.

* VS-Very Satisfactory; S-Satisfactory; US-Unsatisfactory; E-Excellent

Legend	Criteria	Legend	Criteria
A	Lodging and facilities	K	Natural beauty
B	Food facilities	L	Climate
C	Shopping facilities	M	Security of tourists
D	Night-time recreation	N	Artistic and architectural feature
E	Facilities conducive to health, rest	O	Festivals
F	Education facilities	P	Distinctive locals
G	Sports facilities	Q	Fairs and exhibits
H	Accessibility	R	Attitude towards tourists
I	Transport facilities	S	Ruins
J	Communication facilities	T	Monuments, memorials, religious and historical landmarks

Roxas has also a high rating, but its competiveness is limited by lacking a plan for tourism and the necessary infrastructure. Lastly, the competiveness of Dumaran is the lowest, since it is just starting its tourism industry.

Potential for developing tourism in the sub-regional growth area

The table below shows the results of the Potentials Analysis of the municipality of Roxas, one of the sub-regional growth centres. The results for the other two municipalities (Dumaran and Taytay which were not shown on the table below) were also used to determine the regional strategy for the development of tourism. Using this process, the potential for tourism of each municipality was revealed and used in the development of tourism strategies that could be implemented.

In the case of the municipality of Roxas, the strategy focused on developing its agriculture sector and ecological aspects (islands, falls and wildlife). Other municipalities were similarly assessed and the results used to de-

Table 4 Basic potentials of the municipality of Roxas, Palawan.

	Code	Basic Potentials	Code	Basic Potentials
Natural potentials	A1	Mountains	A8	Sand and other minerals
	A2	Forest products (herbal plants, honey, forest litter, hard wood)	A9	Sea grass beds
	A3	Terrestrial wildlife and plants	A10	Marine protected areas
	A4	Endemic and endangered species	A11	Aquatic wildlife and plants
	A5	Waterfalls	A12	Agricultural lands
	A6	Rivers	A13	Islands and islets
	A7	Beach fronts	A14	Seaweed
			A15	Cave
Economic potentials	B1	Agricultural production (rice, corn, etc.)	B8	Seaweed production
	B2	Cashew production	B9	Fish and aquaculture production
	B3	Fruit tree plantations	B10	Van and bus transport
	B4	Livestock production	B11	Private businesses
	B5	Small scale fishing activity	B12	Money transfer facilities and pawnshop
	B6	Lodges and pension houses	B13	Medium-to-large scale live fish trading
	B7	Poultry production		
Infrastructure potentials	C1	Bridge	C8	Communication infrastructures
	C2	Ports	C9	Government buildings and offices
	C3	Road networks	C10	Agricultural facilites (mills, dryers, etc.)
	C4	Water supply system	C11	Telecommunication facilities
	C5	Irrigation system	C12	Reserved relocation site
	C6	Public facilities (halls, courts, etc.)	C13	Airstrip
	C7	Social infrastructures (church, schools, etc.)		
Socio-cultural potentials	D1	Peoples organizations	D4	Traditional values, beliefs and practices
	D2	Sense of Ccommunity	D5	Local language
	D3	Festivals and traditional social celebrations		
Institutional potentials	E1	LGU livelihood support	E5	Responsive line agencies
	E2	Development funds	E6	Peace and order maintenance and support
	E3	Collaborative academic institutions	E7	Provincial government support
	E4	NGOs and volunteers		

velop their respective tourism strategies and to promote complementary growth based on their competitive advantages.

The determination of the basic potentials led to the formulation of derived potentials. These potentials were combinations of various basic potentials. These first level derived potentials were then combined with basic potentials, which resulted in second level derived potentials of the municipality of Roxas, Palawan. This was also done for the other two municipalities (Dumaran and Taytay).

Conclusion

The municipalities of Dumaran, Roxas and Taytay have the characteristics of peripheral areas associated with tourism growth poles on the northern mainland Palawan. Indicators such as population growth, population density, socio- economic character, spatial stratification and market orientation indicate that the municipalities of Roxas, Dumaran and Taytay are sub-regional growth areas as the growth in these municipalities is lower than in the growth poles.

All three municipalities in the sub-region studied suffered similarly (e.g. the greater employment prospects and standard of living in tourism hot spots were greater than locally, which resulted in a migration of people to the hot spots, over exportation of primary products and ecosystem disruption by supporting the continuous growth of the centres of tourism. Such implications include the positive economic gains for Puerto Princesa and El Nido in terms of their vibrant tourism industries, but more significantly, the inevitable negative effects on the established relationships in the sub-regional area (Dumaran-Roxas-Taytay), which resulted in economic losses from decrease in employment and a reduction in population and investments.

The continuous providing of agricultural and other primary products to Puerto Princesa and El Nido, resulted in the ecosystem in the sub-region (Dumaran-Roxas-Taytay) being severely damaged due to a demand-driven conversion and use of natural resources to augment the increasing demand for ecotourism services.

Table 5 First level derived potentials based on combinations of various basic potentials of Roxas, Palawan.

Code	First level derived potentials	Combination of basic potentials to form first level derived potentials	Code	First level derived potentials	Combination of basic potentials to form first level derived potentials
F1	Processing of cashew into butter	A3, B2, D1, E1, E5	F14	Establishment of private business groups	B6, B7, B11, B12, B13
F2	Improved farm-to-market roads	A8, C3, C4, D1, E2, E7	F15	Establishment of tourism information center	A8, C6, C7, C8, E2, E4, E5, E7
F3	Improved management of MPAs	A4, A10, D1, E3, E4, E7	F16	Development of small scale business enterprises	E5, E7, B11
F4	Inventory of wildlife species (flora and fauna)	A3, A4, A10, A11, D1, D3, E3, D4, E6, E7	F17	Biodiversity Showcase	A3, A4, A8, A9, A10, A12, A13, A14, E3, E4, E5, E7
F5	Active, diversified, empowered and well organized community groups	D1, D2, D3, E3, E4, E5, E7	F18	Nursery/ mass propagation of economic plants	A2, A3, A4, E3, E4, E5, E7
F6	Forest products production (honey, forest litter, rattan, etc.)	A2, A14, D1, D2, E1	F19	Integration of municipal plans	E2, E3, E7
F7	Crop producers' cooperative	B1, B2, B3, D1, D2, E2, E4	F20	Active research on identification of other possible tourism sites	B6, B9, D2, D3, D4, D6, E3, E4, E5, E7
F8	Fish community cooperative	B5, B7, B8, D1, D2, E2, E4	F21	Development of marketing strategies for local products	B1, B2, B3, B5, B7, B8, B10, B12, C7, D1, E1, E3, E4, E5, E7
F9	Livestock producers' cooperative	B4, D1, D2, E2, E4	F22	Improvement and exploration of sustainable sources of electricity	A5, A6, B1, D1, E2, E3, E5, E7
F10	Post-harvest food processing	B1, B2, B3, B4, D1, E1, E5	F23	Improve quality of water	C4, E1, E2, E3, E4, E5, E7
F11	Improved water supply and irrigation system	C4, D1, E2, E7			
F12	Establishment of conservation sites	A3, A4, A8, A9, A10, A12, A13, A14, E3, E4, E6, E7			
F13	Research collaboration for tourism development	E3, E4, E5, E7			

Table 6 Second level derived potentials based on the combination of basic potentials and the first level derived potentials of Roxas, Palawan.

	Code	Second level derived potentials	Combination of basic potentials and first level derived potentials to form second level derived potentials		Code	Second level derived potentials	Combination of basic potentials and first level derived potentials to form second level derived potentials
Natural resources and biodiversity related ecotourism potentials	G1	Museum of wildlife	A1, A4, A13, C6, C7, C9, D1, D2, D3, D6, D7, E1, E2, E3, E4. E5, E7, F3, F4, F5, F12	Coastal and Marine Ecosystem-Related Eco-tourism Potentials	G9	Island/islets adventure tour packages	A4, A9, A11, A12, A13, A14, A15, A18, B13, C2, D3, E2, E5, F5, F8, F12, F13, F15, F16, F20
	G2	Wildlife encounter package	A1, A3, A4, A11, B10, B11, C3, C6, C7, C8, C9, C11, D1, E1, E2, E3, E4, E5, E7, F4, F5, F12, F13, F14, F15, F16		G10	Island living experience	A4, A9, A11, A12, A13, A14, A15, A18, D2, D3, E1, E4, E6, F5, F8, F12, F13, F15, F19
	G3	Falls tour package	A1, A5, A6, B10, B11, B13, C3, C6, C7, C8, C9, C11, D1, E1, E2, E3, E4, E5, E7, F4, F5, F12, F13, F14, F15, F16		G11	Kayaking and boating	A4, A9, A11, A12, A13, A14, A15, A18, B13, E2, E7, F5, F8, F12, F13, F16
	G4	Bat watching	A1, A13, A15, B10, B11, B13, C3, C6, C7, C8, C9, C11, D1, E1, E2, E3, E4, E5, E7, F4, F5, F12, F13, F14, F15, F16		G12	Coral reef snorkeling and diving	A4, A9, A11, A12, A13, A14, A15, A18, B13, D3, E2, E5, F5, F8, F12, F13, F15, F16, F20
Agriculture-related ecotourism potentials	G5	Improvement and diversi-fication of poultry and livestock industry	A2, A6, A10, A11, A12, A14, B1, B2, B3, B4, B5, B7, B8, B9, B11, B13, C1, C2, C3, C4, C5, C10, D1, E1, E2, E3, E4, E5, E7, F1, F2, F3, F4, F5, F6, F7, F8, F9, F10, F11, F16		G13	Countryside resort living experience	A4, A9, A11, A12, A13, A14, A15, A18, B13, C2, D2, D3, E2, E5, F5, F8, F12, F13, F15, F16, F20, F22
	G6	Marketing of processed food products	B11, B12, B13, C11, E1, E2, E3, E4, E5, E7, F14, F16, F18				
	G7	Marketing of agricultural crops	B11, B12, B13, C11, E1, E2, E3, E4, E5, E7, F14, F16, F18				
	G8	Promotion of cashew festival	B2, D1, D2, D3, D4, D5, E1, E2, E3, E4, E5, E7				

Recommendations

The creation of multiple tourism hot spots definitely promotes rural development as explained by the growth pole strategy (Parr 1999). The multiple tourism hot spots will keep up with the increasing needs of the existing tourism centres (Puerto Princesa city and El Nido) in terms of agricultural production while simultaneously creating complementary centres of tourism in the municipalities of Dumaran, Roxas and Taytay. The multiple centres of tourism growth in the sub-region will mimic the "One town one product" approach. The One Town, One Product (OTOP-Philippines) is a priority program of the government to promote entrepreneurship and create jobs (DTI 2011).

However, this strategy needs to be more radical in terms in creating an exemplary tourism service in the municipalities that is well-coordinated so that tourism in the sub-region is beneficial for all the participants. One such success involved a case where regional development was based on the expansion of recreational or tourist activity (Harper et al. 1966).

Although the sub-region has a competitive advantage over the growth poles there is an opportunity cost associated with it. This could be further utilized through a division of labor and specialization. Below are the advantages of the sub region in relation to growth poles (Table 7). Since the municipalities in the sub-region focus on agriculture, most of their competitive advantage is associated with agriculture. In addition, differences in their endemic species, historical sites and local products were also included in their competitive advantage.

In essence, the development of many centers of tourism may lead to sustained strong economic growth (Lin 2010). Since the sub-region has a competitive advantage over the growth poles, prioritization and strengthening of the potential could further reduce the gap between developments in the two regions.

Forest and marine fisheries will help the municipality of Dumaran to highlight its competitive advantage as it is endowed with rich and diverse forest and marine resources.

Roxas, as a largely agricultural economy and must focus on its flourishing agro-industry, promoting agro-ecotourism as its competitive advantage and add value and diversify its agricultural products.

Taytay on the other hand, must continue to supply fish to the province and also develop a fishing village industry. Also, its heritage potential undoubtedly could be an attraction for tourists.

These developments in the tourism industry will only be possible if the current state of their ecosystems is

Table 7 Competitive advantages of the municipalities in the sub-regional growth area (Roxas-Dumaran-Taytay).

Sub-regional Municipalities	Competitive advantage	Ecotourism potential
Dumaran	Philippine cockatoo (Katala), WW-II ruins (shipwrecks), mangrove forest, Katala festival	Forest and mariculture
Roxas	Cashew nuts, bat island, sand bar, fresh water turtle, cashew festival, falls	Agro-ecotourism
Taytay	Spanish fort, malampaya sound, irrawaddy dolphin, balinsasayaw cave, lagoons, limestone formations, island formations, Spanish ruins, Spanish light house, Pasinggatan festival, white squirrel, white sand beaches, lake, coral reefs, wildlife species, giant flying fox	Agro-marine ecotourism

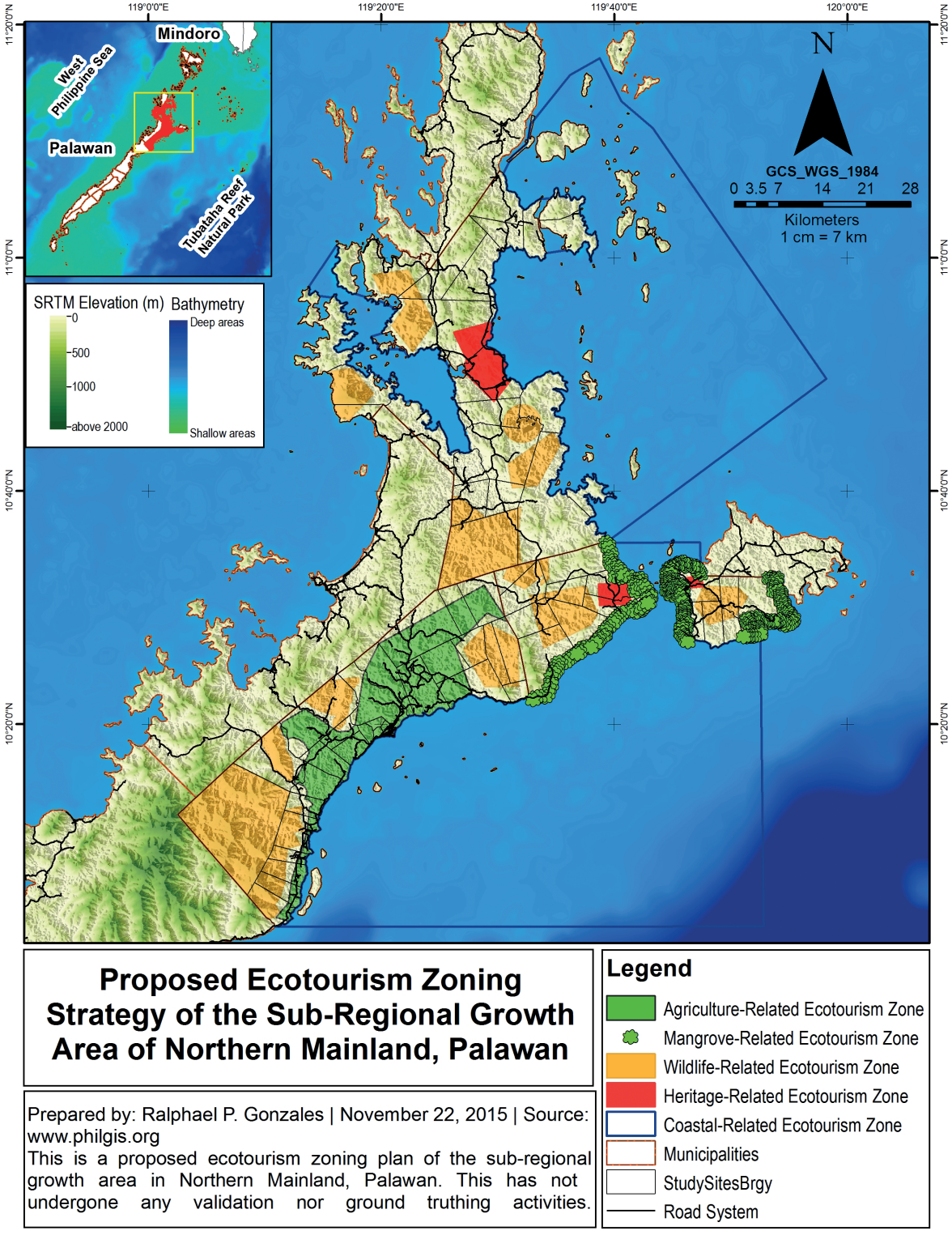

Fig. 2 Proposed development of tourism in the province of Palawan based on the results of the Potentials analysis.

taken into consideration and proper community-based guidelines are established. In addition, to integrate the developments in Dumaran into this region's ecotourism.

For Roxas and Taytay, a specific regional level working group must be formed in order to coordinate their activities in relation also to the existing ecotourism industry of the whole northern Palawan region.

Regional tourism as a strategy is proposed in order to limit the increasingly negative effects of polarization of tourism associated with the developments in Puerto Princesa and El Nido. This strategy emanates from the growth pole concept, but to create multiple ecotourism growth poles that include the unique potential contributions of Dumaran, Roxas and Taytay will greatly complement the already existing tourism industry.

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ISLAND-MAINLAND NEXUS: THE CASE OF THE COASTAL LIVELIHOOD OF TINGLOY ISLAND AND THE SOUTHWESTERN PORTION OF BATANGAS, PHILIPPINES

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ABSTRACT

This research explored the natural resources available to the island municipality of Tingloy, Batangas. It looks at fisheries as the economic resource of an island and how this activity is linked in with the larger economic context of the mainland. Tingloy is a rural settlement the livelihood of which is dependent on fishing and its spatio-economic links with the mainland through fisheries. Fishing is the subsistence economy of Tingloy, with the surplus exported to the mainland. However, a fishery product flow analyses showed that the fishermen of Tingloy are marginalized by the disproportionate distribution of the income in favour of middlemen and fish dealers. Support facilities (such as ports, cold storage, processing units, trading posts, etc.) to further improve the local economy of the island is limited and must be upgraded. Also, transport facilities and other infrastructures to assure the integration of the local-regional economic function of the island municipality must be carefully crafted. Interventions to further improve the local economic condition of the island and its integration with that of the mainland are directed towards improved institutional arrangements, stricter implementation of existing local ordinances, and regional development planning that would take a holistic view and consider the vast resource base of the local government units.

Keywords: island-mainland interaction; livelihood; natural resources; spatio-economic linkage; spatial planning

Introduction

Islands provide several unique ecosystem services (provisioning, regulating, supporting, cultural/aesthetic, etc.) important for the sustained development of a larger spatial landscape. According to Agenda 21, small islands are strategically important environments and the development of their resources need to be properly managed.

The reality that island ecosystems are fragile and vulnerable emphasizes the need for island management. Sustainable island management as an approach will provide the means to conserve the natural functions of island ecosystems. Furthermore, effective island management will define the synergistic development of the island and the larger regional spatial landscape it interacts with.

Among the many amenities supplied by the island ecosystem include fishery resources that sustain the livelihood of local communities. A study on the Pacific Coast of North America by Fitzhugh and Kennett (2010) shows two concurrent major factors in the small-island and mainland interaction over time: (1) the degree of socio-economic self-sufficiency of island populations and (2) the nature of resource distribution and the socio-political dynamics. Issues of island isolation emerge if consequences of these interactions are not resolved. However, another more relevant dilemma is the consequence of the distribution of the gains from which inequality emanates. The centre-periphery continuum is very evident in the context of an island-mainland spatial interaction (Grydehoj 2014).

In addition, the government pays little or no attention to small island systems leading to the continuing threat of isolation from the mainland because they are located far from political and economic centers (CCS et al. 2011). In the Philippine archipelagic landscape, there are many small islands the development of which must be properly integrated into the national spatial planning and development agenda. Many small islands in the Philippine archipelago are neglected and little prioritized even if they are of outstanding ecological, economic or social value. The problem of human development, subsistence economy, land tenure and management, governance and institutional issues are common phenomenon in small island systems in the Pacific (Schoeffel 1996).

The goal of this paper is to show the disparity in the economic resource exchange between an island and the mainland in terms of fishery resources using the case of Tingloy Island municipality and the Southwestern Batangas province in the Philippines.

The Island of Tingloy in the context the Southwestern Batangas (mainland)

The natural coastal/marine resources of Tingloy Island

Islands are usually rich sources of fishery products. This is true, especially for Pacific islands, including the archipelago of the Philippines, an area that is teeming with a rich marine biodiversity. Various fish stocks are harvested by the fishermen in this municipality and this is affected in several ways: (a) although a wide array of fish are present, the actual catch of each fish stock also varies and changes based on what is actually available; (b) the catch is very much attuned to the daily survival of

the fishermen, who characteristically maintain a small-scale fishing activity (Smith et al. 1983); and (c) the harvest of fish by the fishermen of Tingloy is very variable because they use traditional fishing gear/equipment. An estimated 105 tons of fishery resources (75 tons of fish and 30 tons of squid) are harvested by the island municipality of Tingloy.

Barangay (the term used to specify the smallest political unit in the Philippines, is equivalent to a village) coastal water fishing is especially relevant as they use non-motorized boats and shoreline fishing. The common fishing grounds of the majority of the fishermen on Tingloy are the easternmost and westernmost parts of the island, and the open waters of Balayan Bay, Batangas Bay and the Verde Island Passage (Fig. 1).

There are a variety of fish stocks available and harvested in the fishing grounds surrounding the island (Table 1). The reef fish and other seafood (squid, octopus, etc.) in the fishing grounds surrounding the island are the source of the main harvest. According to the fishermen of Tingloy, the catch of fish during the months of November to May (*Amihan* season) is better than in the rest of a year. This is due to the prevailing winds/monsoon influencing the capacity of fishermen to harvest fish (Alix 1976; Castillo 2011) and it has a huge effect on the availability of the marine biodiversity for harvesting, especially in the case of the Philippine archipelago (Barut et al. 2003).

The challenges for Tingloy Island

The traditional fishing technologies used by the island population are not seen as a challenge; however, with the limiting of the areas that can be harvested and encroachment of fishermen from other municipalities, some fishermen opt to use motorized and large-scale fishing activities in order to survive. The introduction of new fishing methods frequently leads to a decline in fish stocks and the impoverishment of many traditional subsistence fishermen (Quinn 2009). In addition, the monsoon dictates the kinds of fish in the fishing grounds since fish are highly dependent on wave action and direction of the prevailing wind.

The other problem with this economic resource is that freshly caught products must be sold to middlemen, because of the lack of electricity on the islands prevents the fishermen storing and further processing their catch. These limits are imposed disproportionately by people with strong ties to urban and big city populations who direct the development of rural island economies (Lichter and Brown 2011). The limits in terms of facilities result in island communities suffering from the unbalanced financial distribution of their resources.

The local fishermen must be encouraged to form cooperatives and organize themselves to maximize their earnings from the products they sell. The significant effect of fishery cooperatives on fish income reveals that fishery cooperatives do serve their purpose by improving

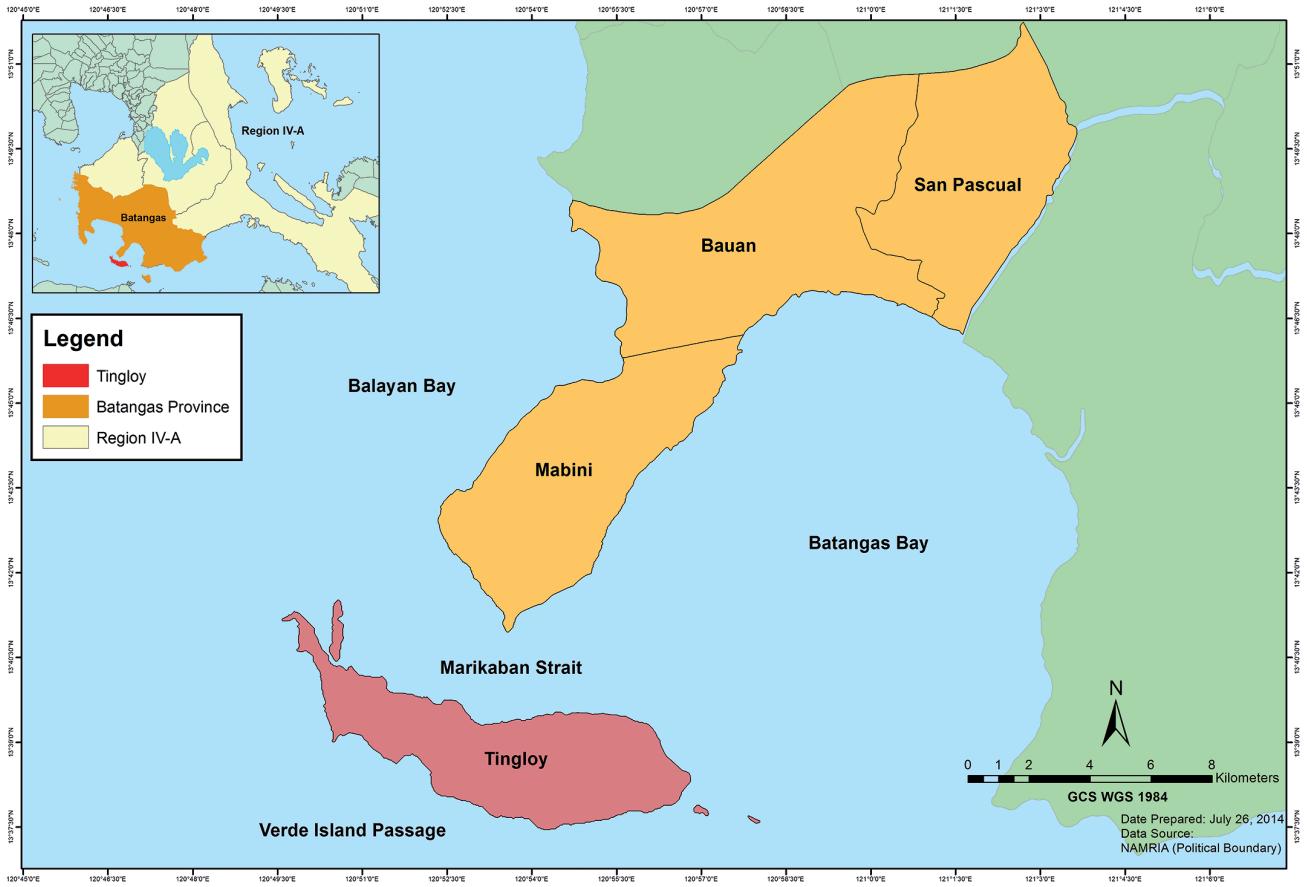

Fig. 1 Map showing the location of Tingloy Island and the Southwestern Portion of Batangas, Philippines.

Table 1 List of the main fish stocks harvested in Tingloy waters during the monsoon season.

Fish Stocks/Species (Local Names*)	**Northeast Monsoon (Amihan)**	**Southwest Monsoon (Habagat)**
goby (*burot-burot*), yellowtail fusilier (*dalagang bukid/buglaw*), scad (*galunggong*), skipjack tuna (*gulyasan*), flat needlefish (*kambabalo*), surgeon fish (*labahita*), flying fish (*bolador/lagidlid*), grouper (*lapu-lapu*), long-jawed mackerel (*alumahan*), purse-eyed scad (*matangbaka*), red snapper (*maya-maya*), trevally/jack/cavalla (*talakitok/maliputo/muslo*), yellow fin tuna (*tambakol*), spanish mackerel (*tanigue*), mackerel tuna (*tulingan*)	=	=
long-jawed mackerel (*alumahan*), anchovy (*dilis/ balakwas*), short-bodied mackerel (*hasa-hasa*), starry triggerfish (*pakpakan/pigit/pakol*), sardinella (*tamban*)	<	>
sea bream (*bakoko*), big eyes snapper (*burara*), needle fish (*batalay/hambabalo*), threadfin bream (*bisugo*), *grouper* (*kulapo*), black or white marlin (*malasugue*), bigeye trevally (*manitis*), blue marlin (*layag-layag*), celebes threadfin bream (*tingin*)	>	<
starry gobi (*dulong*), parrot fish (*purak-purak, loro*), tuna (*pusing*)	✓	x

(*) Local names and English translations are based on those in fishbase.org.
(<) Indicates that the catch of a specified fish stock is less in the monsoon season.
(>) Indicates that the catch of a specified fish stock is greater in the monsoon season.
(=) Indicates that the catch of a specified fish stock is the same in both monsoon seasons.
(✓) Indicates that these species are usually only caught during this monsoon season.
(x) Indicates that they are very seldom caught in this particular monsoon season.

the monitoring of fishing efforts, creating better market opportunities, providing greater bargaining power or reducing transaction costs (Garoma et al. 2014).

The comparative advantage of Southwestern Batangas

The Southwestern Batangas is composed of three municipalities: Mabini, San Pascual and Bauan (Fig. 1). These municipalities collectively support the provincial capital and an international port. Services provided by these municipalities include transport and communication services, manpower and human resources, processing, manufacturing and marketing, etc. These are the general economic activities of the three municipalities making up Tingloy Island, which is the raw material goods provider, especially of fishery resources.

Infrastructure development and access to a larger market are among the few advantages of the Southwestern portion of Batangas compared to the island municipality of Tingloy, which is geographically isolated. Physical infrastructure such as road networks, market, cold storage, electricity and post-processing facilities are abundantly available. As investment in production factors became attractive, the former major restriction on fish production, poor transport conditions, mostly disappears (Olsson 2009). These advantages (southwestern Batangas) made it easier for the mainland to assume the role of post-processing and marketing of raw material goods harvested by the island municipality. This further defines the island municipality as rural settlements in the province of Batangas that provide the larger human settlements with agricultural and raw materials.

Access to a larger market, through improved road networks and transportation facilities, is obvious on the mainland. In a similar study, the existence of an adequate and efficient road network is crucial and a prerequisite of access and provision, thereby providing easier movement for citizens and a means of alleviating poverty (Fan and Chan-Kang 2008). People can easily reach the markets and trading posts on the mainland, where raw fishery goods are stored. Resort owners and restaurants that require fresh fish also go to the coastal areas of the mainland (Southwestern portion of Batangas), which make these locations strategic sites for the exchange of goods.

Movement of Fishery Products between the Island and the Mainland

Flow of fishery products

Tracing the movement of fishery products from the fishing grounds to where they are consumed reveals a specific route (Fig. 2).

The fishery product flow from Tingloy starts in the fishing grounds, where fish, squid and octopus are caught. These are then moved by the fishermen to the middlemen (*casa*). The fishermen can be placed in one of three categories: (a) those that rent or borrow a boat for them to be able to fish (*mamamalakaya*); (b) those that have an agreement with the middleman that enables them to have a boat on loan, so long as their daily fish catch goes directly to the middlemen as a form of payment for the boat; (c) those independent fishermen who own their boat and choose to either use the middlemen or go directly to the market or trading posts to sell their fresh goods. This is not only a characteristic of Tingloy Island, as the study of Agbebi and Fagbote in 2012 indicates that middlemen control most of the market. The many functions performed by the middlemen include the following: maintaining contact with buyers, negotiating prices, delivery, transfer of title; providing credit or collecting money, servicing of products; providing an inventory and storage and arranging transportation.

After being sorted and transported by the middlemen at the trading posts, fish dealers buy and trade the produce on a wholesale basis. These fish dealers and vendors transport these products to the markets in the adjacent municipalities. Sometimes, consumers buy directly from the trading posts in order to have a better choice of fish at a lower price. This fishermen-middlemen interaction is another example of the patron-client relationship, wherein, the patron (middlemen) benefits from such a relationship by an assured supply of a produce (Lim et al. 1995).

The diagram (Fig. 2) also shows the spatial division of the flow of fishery products. The upper part of the diagram, showing the actual fishing activity up to when it reaches the middlemen is mainly the concern of the island municipality of Tingloy. The trading and consequent distribution of these fishery products occurs on the mainland. Mabini is the common drop-off point of the fish catch from Tingloy Island and from there, the distribution flows from the Markets of Mabini, Bauan and San Pascual. The spatial allocation of the activities may also imply the extent of the extraction of natural resources, clearly, in this case, much of this occurs on the island and in surrounding areas, whereas, the financial benefits that could protect or conserve these resources do not come back to this area.

This movement of fishery products is mainly within the region except when the catch is sufficient for the fish dealers to transport it to Batangas City. However, in the case of squid, the product flow extends to Batangas City as the demand there for squid is higher.

Spatial linkage of island and mainland

Providing a spatial dimension for the flow of fishery products entails tracing the actual movement of the products from one place to another. Fig. 3 shows the actual flow of fishery products in space. This is represented by the lines coming from the island municipality. The lines surrounding the island municipality shows that the fish caught on the fishing grounds are brought back to the island municipality for local consumption. The lines extending from the municipality to the mainland and other areas show the outward flow of fishery products. Buying and selling freshly caught fishery products is an informal trade within the island municipality. Often, only the excess fish is sold to the local communities as the best quality fresh products are directly sold to the middlemen.

The outward flowing lines from the island municipality of Tingloy to the mainland represent the economic linkages between the island municipality and the mainland. The economic flow, in terms of the fishery products, are clearly indicated on the map in Fig. 2. The established links between the island municipality and mainland are: (a) Tingloy- Mabini (Anilao and Talaga) for the region under consideration; (b) Tingloy-Lemery, for the linkage, however seldom, between the island municipality and other municipalities on the mainland; (c) Tingloy-Batangas City, both direct and through land transportation (Tingloy-Mabini-Batangas City); this linkage is very evident especially in the flow of squid; (d) Tingloy-Verde Island (Small Islands linkages), Verde Island is under the jurisdiction of Batangas City where several barangays are situated; and (e) Tingloy-Mindoro (Calapan City and Puerto Galera), are economic linkages driven by the booming tourism on the island province of Mindoro.

The economic linkages between Tingloy and the mainland are manifested in the physical link between

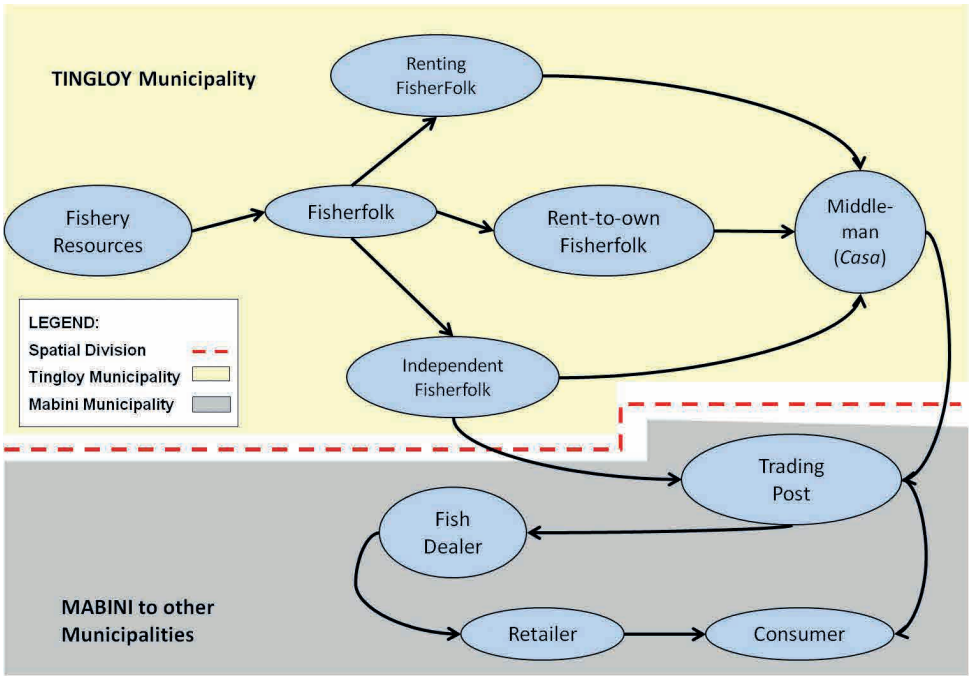

Fig. 2 Fishery product flow between Tingloy Island and the southwestern Batangas.

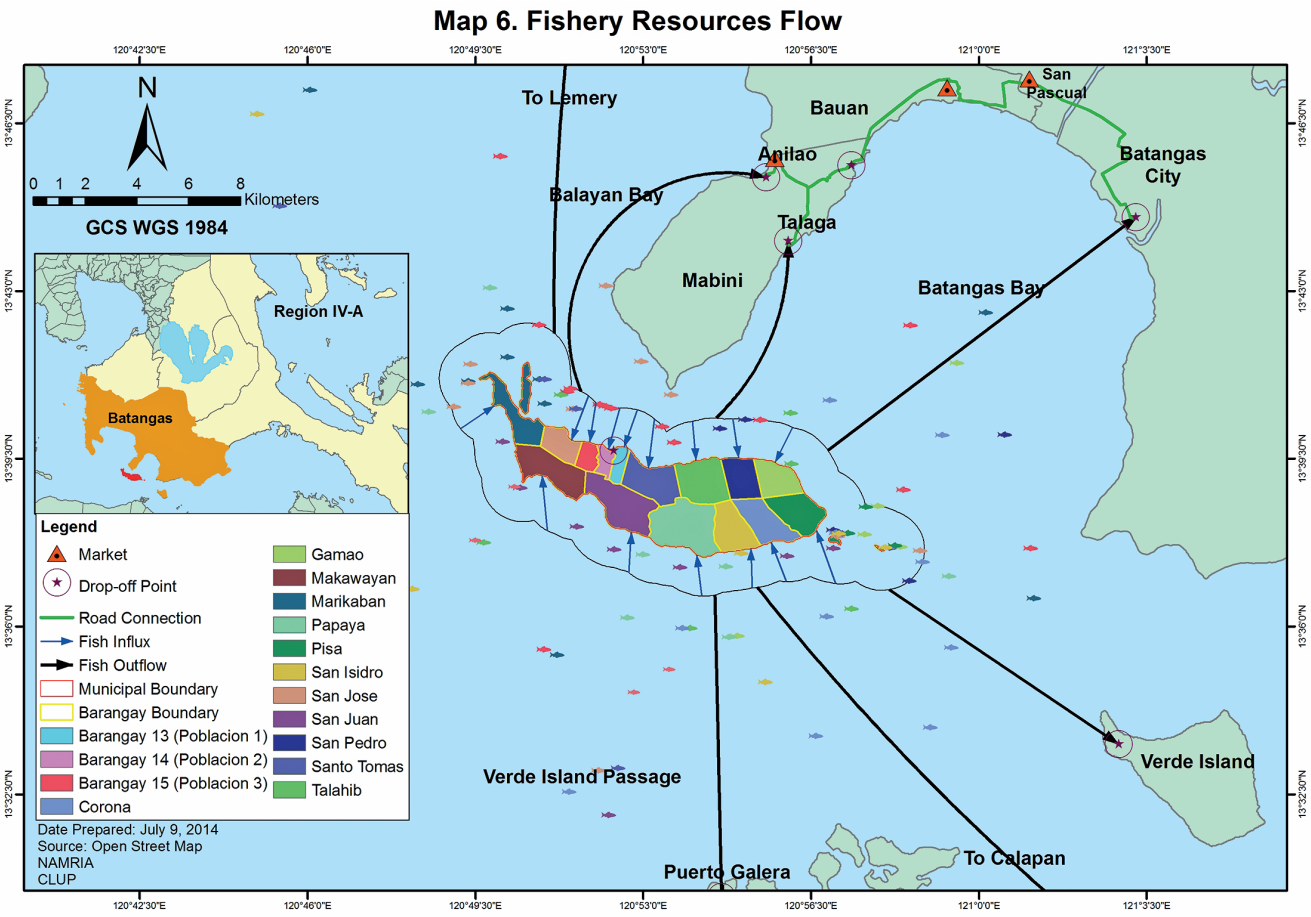

Fig. 3 Flow of fishery products in the region.

Tingloy and Mabini. This linkage is a well-established sea-route for the transport of people using motorized-boats. There are two (2) ports in the municipality of Mabini (on the mainland) that are used to connect to the island municipality of Tingloy. Fish landing sites are also present in Mabini, whereas, in the island municipality of Tingloy, only poor quality fish landing sites are available.

Since the markets of the municipalities of Bauan and San Pascual are alongside a road this results in a spill-over interaction in the existing economic flow between Tingloy and Mabini. Road networks connecting Mabini-Bauan-San Pascual to Batangas City also make it possible for fishery products to flow within the region (mainland).

Given such conditions and the integration of the flow of fishery products, then the expectation is that income and employment opportunities will increase throughout the wider community (World Bank 2006). Such an expansion is championed by the 2014 study of Nshimbi and Vinya in 2014, which emphasizes that it must include the management of natural resources, improvements, diversification in agriculture, agroforestry and ecotourism (World Bank 2006), and the provision of an efficient marketing system. However, the organization and management of these resources seems to need more time for full integration.

Valuation of fishery resources

The existing interaction between the island municipality and the mainland through fishing activity can be further analysed using a value chain analysis. This tool differs from commodity flow analysis as it centres on the monetary or value added to a particular resource flowing through a system. Furthermore, value chain analysis focuses on systems, and how inputs are changed into the outputs that are purchased (Porter 1985). Since the product in the flow under consideration is a primary or raw material, its value is not increased very much (Table 2).

The commodity starts to incur added value only during transportation by the middleman. The added value for such a commodity is attributed primarily to the costs of transporting the goods from one place to another and the service fees charged by the middleman. The same occurs in the later stages where the commodity incurs added value right up to when it is consumed. The fishermen cannot impose prices for their commodities as they are usually determined by the patron-client agreement existing between them and the middlemen.

In Table 2, it is clear that although there is an economic linkage between Tingloy and the mainland, the distribution of the actual income from the commodity is not even, because the fishermen are marginalized. The value placed on the intensive labour input of the eco-

nomic activity of Tingloy fishermen is less than that on the mainland employment involved with distribution and sale of the same commodity (fishery products) in the region.

Looking closely at the value chain analysis, a range totalling PhP 20.00–40.00 for fish products and PhP 20.00–30.00 for squid per kilogram is the gross income of the middlemen (50.00 PhPeso = 1.00 US Dollar/2016). If this is calculated in terms of the minimum number of kilograms transacted in the trading post (50 kilograms) and deducting all other expenses (transportation and other fees) they incur, the net income of the middlemen is PhP 1684.00 to 3184.00 per day.

The fish dealers and vendors, have an income of PhP 20.00 per kilogram for fish products and PhP 60.00–80.00 for selling a kilo of squid. Taking a minimum of 50 kilograms of fish products sold by fish dealers/vendors in the market and deducting all other costs, the net income of the fish dealers and/or vendors is PhP 3440.00 for fish products and PhP 4000.00 for squid.

In addition, the price of the fishery products is dictated by the middlemen and in other studies conducted by Bryceson in 1993 and Visser in 2015, the earnings of middlemen is considerably greater because they control in the market. Also, the collection and consequent reselling of products to the vendors is also controlled by the middlemen, which forces the fishermen to directly deal with the market (Agbebi and Fagbote 2012). Bystrom in 2014 also shows that for the traditional fishing activity, the entire catch of snappers can be priced at US$ 1.50 per fish, which end up in local resort Restaurant's plate at around US$ 25.00 per fish. A similar situation leave Tingloy fishermen with little control over their condition. Furthermore, the fishermen are also limited by the uncertainty of their catch caused by the conditions imposed by the natural environment and the capacity of the fishing gear they use.

Conclusion

The island municipality's role on the mainland (Mabini, Bauan and San Pascual) is that of a rural settlement providing raw materials. Tingloy provides fishery products for livelihood generation. This synergy extends even far beyond the three municipalities under consideration and includes Batangas City and the municipality of Lemery. This physical link is very evident through the established buying and selling of fishery products. However, the benefits from fishing are not properly distributed resulting in the marginalization of fishermen in Tingloy, this is clearly manifested in the commodity

STAGES	Description	Units Accounted	Number of Units Used		Price per Unit (PhP)		Total Cost (PhP)		Value Addition (PhP)	
			Min	Max	Min	Max	Min	Max	Min	Max
Preparation	Preparatory Activities for fishing activities (Maintenance of Input, buying of inputs required	Motorized Boat Fishing Gear (Set) Man Power	1 2 2	- - -	96 25 100	- - -	96 50 200	- - -	- - -	- - -
Actual Fish Catching	The actual activity of catching Fishery resources	Fisherman's Food Fisherman's Water Fish Bait (set)	2 2 1	- - -	20 20 100	- - -	40 40 100	- - -	- - -	- - -
Sorting and Storing	Collation of fishes and other catch and consequent storing in containers	Fish Containers Plastic Cover	2 2	- -	1 1	- -	2 2	- -	- -	- -
Sea Transportation	Transportation of Fish and other catch from the fishing grounds to the middleman	Gasoline for motorized boat (Liters)	2- - -	- - -	60 - -	- - -	120 - -	- - -	- - -	- - -
Collection of Fish Products	Collection by the middleman	Fishes (kilogram) Squid (Kilogram)	3 5	7 15	80 30	120 100	240 150	840 1,500	- -	
Transportation by middleman	Movement from the middleman bringing to the trading posts	Motorized Boat Gasoline Other Fees	1 2 1	- - -	96 60 100	- - -	96 120 100	- - -	- - -	- - -
Wholesaling by middleman	From the trading post, the middleman will sell the catch in bulk	Fishes (kilogram) Squid (Kilogram)	3 5	7 15	100 60	160 120	300 300	1,120 1,800	60 150	280 300
Retailing Fish Products	From Wholesale trade to the fish vendors in the market	Jeepney Gasoline Manpower	1 2 1	- - -	400 60 100	- - -	400 120 100	- - -	- - -	- - -
Final Consumption	Market Fish vendors selling the fish catch to the consumes	Fishes (kilogram) Squid (Kilogram)	3 5	7 15	120 120	180 200	360 600	1,260 3,000	60 300	140 1,200

Table 2 Value chain of the fishery products in Tingloy, Batangas.

flow diagram. Furthermore, the income from the fishing activity mainly goes to the middlemen and retailers on the mainland.

This results in a spatial divide in the economic benefits between the island and mainland. Furthermore, with limited economic opportunities, some implications for the fishermen of Tingloy are the evident exhaustion of their subsistence economic resource and the over exploitation of other fishery resources. Also, the overworking of the fishermen is to be expected.

Recommendations

Improved coastal management/stricter enforcement of municipal water laws and protection of the MPAs

The following must be done simultaneously: (a) conservation of fishing grounds using sustainable fishing technologies; (b) restoration and increase in the number of people manning the area, (b) improve marine protected areas (MPAs) by zoning; (c) buildings for the local coast guards and for training people in effective conflict management, provision of basic incentives for workers (health and emergency funds, insurance, etc.), increase in the work force among the local coast guards; (d) alternative livelihood generation that will cater for both the fishermen and the local community.

Storage and further processing of fishery products on the island

Storage facilities for maintaining the quality of freshly caught fish could enable fishermen to avoid wastage when catches are high. Processing of goods into more valuable products must be complemented by improving the techniques used in harvesting or catching fishery products by packaging those that are harvested in municipal waters. Strategic branding and marketing of fishery products could further promote the products of the region that are not only competitively priced in the local market but also internationally.

Creation

Fishing cooperatives can be especially important for the management of sustainable fisheries, especially in areas where governance is weak (Rife 2015). Middlemen should be an integral part of the cooperative in order to assure their participation and reassure them that their role will not be taken over by the cooperative. The characteristics of the cooperative should be: (a) members are the fishermen at the barangay level and the middlemen; (b) it must have an information-base, using mobile phones, or any other simple yet effective means of communication; (c) have strong links with the trading posts on the mainland; (d) have a source of finance available for funding all members, plus an emergency fund; and (e) continuously train staff in cooperative management, building team rapport and managing finances.

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GREEN JOBS, A NEW MEASURE OF PUBLIC MANAGEMENT AND SUSTAINABLE DEVELOPMENT

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ABSTRACT

The aim of this article is to propose a measurable definition of green jobs based on balanced, durable and sustainable development, which is an example of both the Green Economy and New Public Management (NPM) concepts. This approach is justified due to the nature of NPM, which uses the goals of management and measures of effectiveness. In this paper, the definition of green jobs is formulated as tool for measuring, based on the Polish Classification of Activities (PKD), which has roots in the classifications proposed by UN the ISIC and Eurostat NACE. Then the ease with which this tool can be used is tested by determining the efficiency of labour market institutions. Therefore, the green jobs concept can be much wider than just a qualitative description of an organisation's strategy. In this paper it is proposed that green job characteristics based on section E of PKD is more specific and because of its quantitative approach it is a suitable measurement not only in Polish conditions, but generally.

Keywords: durable and sustainable development; efficiency; green jobs; green employment

Introduction

Sustainable and durable development is a popular and very important concept, which is open to a variety of interpretations. Since the Brundtland report was published in 1987 (Bruntland Commission 1987), many researchers in universities, environmental organizations, national governments and international agencies have put forward proposals for measuring sustainable development. The quiddity of sustainable development is in balancing the relations between economy, society, space and environment and choice of its durability. The wide variety of indicators in existing national and international policy-based sets testifies to the difficulty of this challenge.

The assessment of sustainable development or green jobs is difficult, however it can achieve positive effects that can be used in other fields of science. There is an ongoing multidimensional discussion in Poland about measurement and analysis of sustainable development and its effect on the environment and economy. Evaluation is important both for scientists and governments and administration, who want to properly manage using tools of New Public Management, which allows them to manage by measuring the efficiency of undertaken actions. These trends have given rise to new calls in Poland and other European Union countries for the integration (Rutkowska-Podolowska et al. 2016) of training and development with economic development, so both can be aligned with the political economy (Scully-Russ 2013).

This discussion on the measurement of green economy goals is also visible in an international context in terms of the numerous publications, including those issued by the United Nations (Adamek 2016) on methods of measuring sustainable development. The fundamental questions are intertwined with the green economy and green jobs (Rutkowska-Podolowska et al. 2016), because they reflect the connections of sustainable development with social and financial aspects (Pearce and Atkinson 1993). However, there are very few specific indicators of how to measure, assess and evaluate sustainable development.

New Public Management and Green Economics have a common root in neo-liberalism and in the pursuit of green development (sustainable and sustainable development). Neoliberalism assumes the decentralization and liberalization of the economy through free trade, open markets, privatization, deregulation and a reduction in the role of the state. These tools are an instrument of New Public Management. At the same time, green and sustainable development presuppose decentralization and the liberalization of public authority, among other things, that "it is necessary to limit national public authority to avoid social tensions and to safeguard the fundamental freedoms and rights of individuals."

This article presents a review of what the most important sustainability and New Public Management concepts are based on and aspects of them that it may be possible to measure. For this green jobs are the chosen indicator to be analysed.

Material and Methods

The data for the years 2010–2015 presented by Central Statistical Office (GUS) were used to describe the demand of the labour market for green jobs as defined in

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the E section of Polish Classification of Activities (PKD) in the chosen region of Poland, which is Lower Silesia.

The aim of this analysis is to develop a tool for efficiently measuring green job creation as demanded by NPM. Therefore, green jobs defined as a category of PKD, can be a factor of:

a) durability of the relations between economy, society and environment;
b) assessment of the society's needs to be satisfied in terms of the protection of the natural environment;
c) limitations on human activity in natural environments;
d) pro-ecological management.

Statistical analysis of data that conforms to the quantitative definition of green jobs that can used as an indicator of sustainable development.

Sustainable Development Concept

In the literature the development concept is widely discussed in the context of economic growth (Borys 2005). Both the economy and ecology may contribute to social welfare and incorporate some (limited) degree of sustainability. Sustainable development means that the needs of the present generation should be met without compromising the ability of future generations to meet their own needs (Bruntland Commission 1987). There are, however, reliable indications that labour, capital, and technology influence environmental production factors to such an extent that they are, in the long run, clearly unsustainable in both systems. On the other hand, the demand for certain environmental commodities and amenities (such us drinking water) clearly exceed environmental growth and production rates, and threaten environmental regeneration.

According to the Brundtland Commission (1987), sustainable development includes the concept of needs, in particular those of the world's poor, to which overriding priority should be given and the idea of a limitation imposed by the state on the effect that technology and social organizations have on the environment's ability to meet present and future needs. It is clear that as formulated by the Bruntland Commission sustainable development is more inspirational than practical and neither precise or measurable (Thwink.org 2017).

The concept of sustainable development is not a novel aspect in the evolution of economic thinking. The wish to take account of the needs of future generations while, at the same time, aiming to satisfy the needs of present generations refers essentially to the opportunity of taking account of objectives in both the long and medium terms. However, it is evident that sustainable development currently faces an imbalance when it comes to its three main pillars: economic, social and environmental. The debate has broadened to include more concern for the social dimensions of sustainable development (Scully-Russ 2013). Also, there exists a challenge to treating them equally and a search for ways to achieve the goal of sustainable development for all and promote this as the main gap that has to be filled in order to make the world a safer place. Sustainability and justice are the central policy issues of the twenty-first century and are associated with an even greater challenge: that of finding the political tool to implement solutions (Hess 2012). Therefore, measurement is important for management and planning of sustainable development and the balance of all three pillars (Fig. 1).

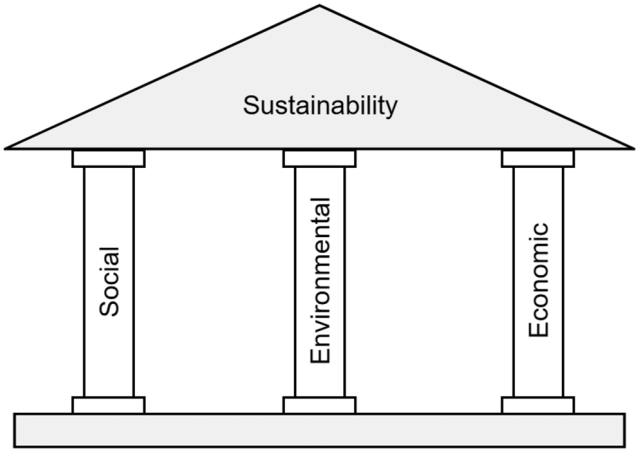

Fig. 1 The three pillars of sustainability. Source: (Thwink.org 2017).

Sustainability is the ability to continue a defined behaviour for an unlimited or unspecified period of time in order to maintain a high quality of life (Fig. 1). Therefore, environmental sustainability is the ability to maintain rates of harvesting renewable resources, producing pollution and depletion of non-renewable resources that can be continued and are durable. Secondly, economic sustainability is the ability to support a defined level of economic production indefinitely. Then social sustainability is the ability of a social system, such as country, to function at a defined level of social well-being.

The scientific outlook on development sees development as its top priority, putting people first and at its core (Table 1) comprehensive, balanced and sustainable development as its basic requirement and overall consideration as its fundamental approach. Its methods are to integrate urban and rural development, regional development, economic and social development, harmonious development between man and nature, domestic development and opening up to the outside world. Its important goals are to make sure that the aims and outcomes of all the work of the state are to realize, safeguard and expand the fundamental interests of the overwhelming majority of the people, respect the principal position of the people, give play to their creativity, protect their rights and interests, and promote their all-round development and social progress (United Nations 1992).

As presented in Table 1, sustainability is related to the quality of life in a community, that is, whether the eco-

nomic, social and environmental systems that make up the community will provide a healthy, productive, meaningful life for all community residents, present and future.

Understanding the three parts and their links is key to understanding sustainability, because sustainability is about more than just the quality of life. It is about understanding the connections between and achieving balance among the social, economic and environmental aspects of a community.

Table 1 Two main streams of sustainable development.

Conformity of axiological foundations	Elements of sustainable development
Defined concept of the quality of life	Sustainability
Defined concepts of social, economic and environmental development	Durability
Defined concept of instruments	Balance

Source: author's own elaboration based on Sulich (2017).

Green Economy

There is no internationally agreed definition of green economy and there are at least eight separate definitions used in recent publications. For example, UNEP has defined the green economy as "one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. It is low carbon, resource efficient, and socially inclusive" (UNEP 2011). This definition is cited in a number of more recent reports, including those of UNEMG and the OECD. Another definition of green economy offered by the Green Economy Coalition (a group of NGOs, trade union groups and others doing grassroots work on a green economy) succinctly defines green economy as "a resilient economy that provides a better quality of life for all within the ecological limits of the planet" (UNEP 2011). Implementation of a green economy can have a significant effect on the human society by:

a) eradicating poverty and hunger through targeted measures to alleviate and eliminate poverty, and enhancing agricultural production capacities and food security;
b) implementing innovation-driven development strategies and generating momentum for sustainable, healthy and stable economic growth;
c) advancing industrialization to inject impetus to coordinated development between urban and rural areas and among the three dimensions of sustainable development;
d) improving social security and social services to ensure equal access to basic public services;
e) safeguarding equity and social justice to improve people's well-being and promoting all-round human development;
f) protecting the environment and building protective barriers for eco-security;
g) addressing climate change actively and integrating the response to climate change into national development strategies;
h) promoting efficient utilization of resources and sustainable energy;
i) improving national governance and ensuring economic and social development in line with the rule of law.

Green Economics covers two aspects. The first is the promotion and implementation of pro-ecological processes across the whole economy, i.e. the reduction of energy and resource consumption and emissions of all pollutants, in order to ultimately achieve the separation of economic activity from pollutant emissions and resource use. Second, a greater share of the green economy across the economy by using green technologies, green energy and low-energy industries to ensure good human health and environment throughout the economic system.

In 2012, the United Nations Conference on Sustainable Development Rio + 20 was held, which focused on the concept of green economy. The international debate has highlighted the need for a new definition of economic principles and the adoption of a new model of socio-economic development called green growth or green economy. Furthermore, it was acknowledged that, in view of the threats posed by human activity, sustainable development and the green economy are the only acceptable alternatives to the brown economy.

With governments today seeking effective ways of leading their nations out of these related crises whilst also taking into account these planetary boundaries, green economy (in its various forms) is proposed as a means for catalysing renewed national policy development and international cooperation and support for sustainable development. The concept has received significant international attention over the past few years as a tool to address the 2008 financial crisis as well as one of two themes for the 2012 UN Conference on Sustainable Development (Rio+20). This has resulted in a rapidly expanding literature including new publications on green economy from a variety of influential international organisations, national governments, think tanks, experts, non-government organisations and others.

Green Economy is a factor that generates structural changes in economic and social life. A new direction of change is the introduction of environmental criteria into production processes, investment and consumption, which in turn leads to the growth of the green economy, to green growth expressed in the growing share of the green economy in the creation of gross domestic product and green jobs. The green economy ensures that everyone who is willing to work can find a good job for themselves. Green Economy strives to balance the problems of socio-economic development, anthropogenic changes in the environment and demographic and environmental changes that have intensified in the 21st century. It is therefore believed that green economy best expresses all three aspects of sustainable economic, social and

environmental development. This economy is aimed at improving people's well-being while reducing ecological risk and scarcity of natural resources. Continuous social development and progress (understood as ongoing modernization) aim to control the environment through scientific progress and technology and the rational management of public institutions, which in turn accelerate the development of human civilization. This development, as already proposed in 1987, should be based on sustainable development, which is also to meet intergenerational needs

Table 2 Green economy versus modern brown economy.

Brown economy	Green economy
"Unlimited" economic growth	Separating economic growth from the consumption of natural resources
Non-renewable energy sources	Renewable energy sources
Intensive consumption of natural resources (energy and material-intensive)	Energy efficiency
Greenhouse gas emissions	Clean production
Destruction of biodiversity	Biodiversity protection
Global social inequalities	Intergenerational and interregional justice
Unlimited consumption (over consumption)	Sustainable consumption
Lack of Corporate Social Responsibility of Businesses and Investors	Corporate Social Responsibility of Businesses and Investors
Weakening of social trust	Increase in social trust

Source: authors' own elaboration based on Ryszawska (2013).

New Public Management

The New Public Management (NPM) is nothing more than a set of almost every management tool found to be suitable for the public-sector. NPM is practically evaluated, however this concept is far more than a management system or a performance measurement.

The bureaucratic model of management worked exceedingly well for its time, but times have changed and a new approach to management, emphasizing teams and customer service, has emerged to challenge the traditional model of public administration. The reforms of market models take place against the traditional models of public administration as alternative models.

The shift from bureaucratic administration to business-like professional management with NPM was promoted as a strategy fitting for all levels, and branches of the public-sector, local as well as central governments, and every kind of administrative culture in any country whatsoever. NPM has been presented as a remedy to cure management ills in various organizational contexts, as well as in various areas of policy making, from education to healthcare.

The establishment of sustainable development indicators has been for many countries and institutions a key opportunity to move environmental issues higher up the policy agenda alongside economic and social issues within the frame of NPM. The sustainable development indicators have also been instrumental in promoting the concept in a much clearer way than can be achieved through national sustainable development strategies.

In many cases the relationship between indicators and policy is very strong, with the policy framework in effect determining the indicators. While there may be concerns about having indicators closely aligned with policy and hence potentially biased towards particular policy priorities at the expense of other aspects of sustainable development, this is also one of their strengths. Policy makers see them as being directly relevant to the policies they have established and effective for communication.

Within the European Union, at least, there has been some inevitable convergence among the national indicators used. This is for two reasons. Firstly, and most obviously, as newer member states develop their indicator systems, they are likely to be influenced by the indicators adopted at the European Union level. Secondly, and less obviously, the indicators used by the European Union itself have been developed through engagement with older member states and those with well-established national indicator sets have been influential in the direction taken by the European Union.

New Public Management uses primarily legal acts that help implement the principles of Green Economics. In 2010, the European Commission announced a communication entitled "Europe 2020 Strategy for smart, sustainable and inclusive growth", which includes three interrelated priorities:

a) smart development: the development of a knowledge- and innovation-based economy;
b) sustainable development: supporting a resource efficient, more environmentally friendly and more competitive economy;
c) inclusive growth: supporting a high employment economy, ensuring social and territorial cohesion.

It is characterized by a government that uses NPM to develop a leading role and wider public participation, with the aim of improving the quality of life of the poor and increase their capacity for employment and entrepreneurship. To meet this end, the poor labour force is provided with a vocational education, entrepreneurship training and practical training in agricultural techniques. They are encouraged to seek new jobs or start their own businesses. Young farmers in poor areas are offered assistance when they encounter difficulties in employment and entrepreneurship, with an ultimate goal of growth in production, employment transfer, income increase and economic growth in poverty-stricken areas (OECD 2001).

NPM reforms, if they are to be effectively implemented, require a holistic approach, integrating the multiple

human resources, financial, technical and structural factors involved within a dynamic environment. Green activities are key actions of policy makers in countries and regions across the world that can be created in almost all sectors of economy, which help in the sustainable development leading to a greening of the economy and are an important tool for countering unemployment.

Table 3 They key differences between the Weberian model and New Public Management.

Classic (Weberian) model	New Public Management
Hierarchy and functional structure (machine like, rigid and impersonal)	None rigid/pure model of administration Initiatives from bottom of the structure
	Managerialism
Professionalism and specialisation	Maximise public interest rather than self (bureaucracy)
Work division	Cost control and efficiency
Political accountability	Measures the effects based on achieving the goals
Administrative man	Healthy competition, democracy in public administration
Realization of processes	Oriented processes to perfection Client oriented
Centralisation of power – differentiation	Decentralisation Efficiency – regard for personnel
Bounded rationality	High quality services
Public-Private distinction	Public – Private partnership

Source: authors' own elaboration.

Green Jobs

Green jobs should be objective and measurable and this second part is the most difficult for researchers and statistic offices around the world. Assessing the importance of green jobs can be an effective tool for assessing sustainable development, hence it was not previously proposed as an indicator by Eurostat, OECD and UN (UN 2008).

Green jobs are places of employment that contribute to preserving or restoring the environment in traditional sectors, such as manufacturing and construction, or in new, emerging sectors such as renewable energy and energy efficiency (Rutkowska-Podołowska et al. 2016). Moreover, green jobs are a solution for young, unemployed people who not only can find employment but can become entrepreneurs in this sector of the economy.

The United Nation's Environmental Programme (UNEP), which provides worldwide leadership on improving the environment, sees a dual promise in the green economy to protect the environment and provide decent work for the world's poor (Renner et al. 2008).

A green job is any job or self-employment that genuinely contributes to a more sustainable world. At the enterprise level, green jobs can produce goods or provide services that benefit the environment, for example green buildings or clean transportation. For persons beginning their professional career, the meaning and potential of green places for employment is very high (Sulich 2017).

Based on sustainable development a distinction can be drawn between employment in green economic sectors from an output perspective and job functions in all sectors from an environmentally friendly process perspective. For the ILO (2016), green jobs are all those jobs that fall in the dashed area in Fig. 2.

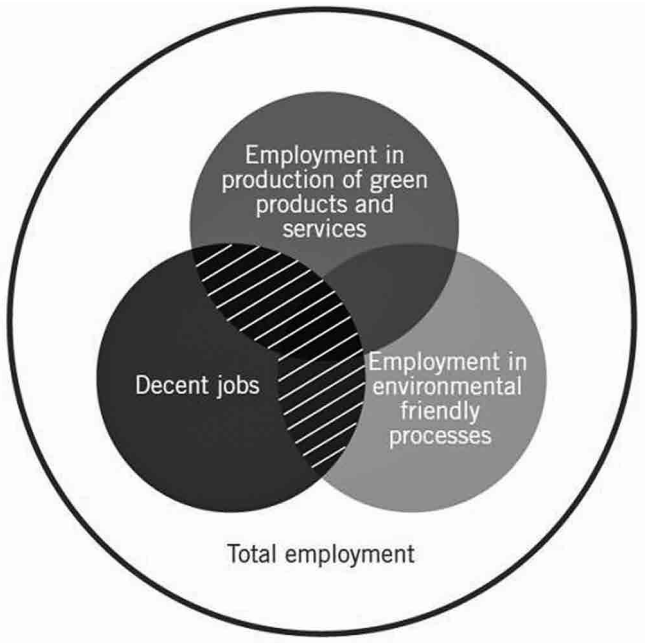

Fig. 2 The green jobs. Source: (ILO 2016).

The concept of green jobs emerged from the so-called green economy, which assumes that green jobs will emerge thanks to new economic paradigms. They will reduce unemployment and prevent the degradation of the environment.

The topic of green jobs is important both for the protection of the environment and the labour market. It represents one of the benefits of sustainable development. One of the objectives of the European Union is to ensure a balance between economic growth and environmental protection.

There are many definitions of the concept of green jobs in the national and international literature. In general, they can be defined as workplaces that support the environment (Popławski et al. 2017). The definition focused on the result of human action defines green jobs as: "jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources". Another approach includes more processes and states that green jobs are: "jobs in which workers' duties involve making their establishment's production processes more environmentally friendly or use fewer natural resources". The concept of green jobs implies, in

addition to the principles of sustainable development, the fight against unemployment by creating decent jobs. Based on these two approaches it is possible to measure and identify categories of green jobs based on the Polish Classification of Activities (Pol. *Polska Klasyfikacja Działalności*, PKD) in Table 4. The PKD is based on the ISIC proposed by the UN and UE standards of the NACE (PKD 2007). The Polish Classification of Activities is an example of national classifications that are used to register a company in Europe, and this classification consists of the same sections and groups as ISIC or NACE classifications. All the mentioned systems of classification are comparable, and allow a comparative study of different activities in different countries. Presented in Table 4 section E is only an example of the quantitative approach to measuring green jobs the qualitative definition of which is formulated above.

Section E was chosen because of the availability of statistical data and its description (characteristic) most closely matches the definitions of most of green jobs. The quantitative definition of green jobs can be extended to other PKD sections, but then there must be a more rigorous selection of the groups, because, for example section A – agriculture and forestry, include activities that are very destructive of the environment and therefore cannot be classified as green jobs.

Table 4 Green jobs based on the E category of PKD.

PKD section	PKD group	PKD description of group
E – water supply; sewerage, waste management and remediation activities	36.0	Collection, purification and distribution of water
	37.0	Sewage disposal and treatment
	38.1	Waste collection
	38.2	Waste treatment and disposal
	38.3	Materials recovery
	39.0	Remediation activities and other service activities related to waste management

Source: authors own interpretation based on PKD (2007).

The number of green jobs that come within the E section of PKD in Poland grows each year by about 1% per year (Table 5). A significant number of green jobs have been created in Lower Silesia in Poland (Table 6). In comparison with the whole country these numbers are not impressive, but in comparison with the creation of all new jobs these numbers are significant in this region for the New Public Management of the green jobs policy in the local labour market.

Among all the 16 provinces in Poland there is one for which the green jobs labour market has been further analysed (Sulich 2017). This study indicates that in this particular province there is a stable and growing demand for green jobs. Moreover, in this province in 2010–2016 25% of young people were first employed doing green jobs (Popławski et al. 2017).

Table 6 Number of green jobs in the chosen province in Poland.

Name of province	Number of work places in E section of PKD						
	2010	2011	2012	2013	2014	2015	2016
Lower Silesia	1081	624	896	1104	781	586	641

Source: authors own interpretation based on BDL (2017).

Indicators connected with the definition based on PKD are more specific and easy to measure, both as number of unemployed or employed, in this specific section. These are traditional measures of communities. All statistical offices use numbers to show progress, but the traditional numbers only show changes in one part of the community without showing the many links between the community's economy, society and environment. Rather than a piecemeal approach, there is a need for a holistic view of the community that takes into account the links between the economy, the environment and society (Table 3). Therefore, it is possible to take actions to improve conditions in a sustainable community that take these connections into account. Indicators of sustainability are different from traditional indicators of economic, social, and environmental progress. Traditional indicators measure changes in one part of a community as if they were entirely independent of the other parts. Sustainability indicators reflect the reality that the three different segments are very tightly interconnected.

Table 7 Traditional and sustainable indicators related to the labour market.

Traditional Indicators	Sustainability indicators	Emphasis of Sustainability Indicators
Unemployment rate	Variability of skill levels required for jobs	Resilience of the job market
Number of companies	Number and variability in size of companies	
	Number and variability in the types of industry	Ability of the job market to be flexible in times of economic change
Number of jobs	Diversity and vitality of local job base	
	Number of green jobs	

Source: author's own interpretation based on Sustainable Measures (2017).

Table 5 Employment changes in E section of PKD in Poland.

Year	2010	2011	2012	2013	2014	2015	2016
Number of employed	142,096	144,411	145,603	146704	147,738	149,909	151,230

Source: authors own interpretation based on BDL (2017).

These indicators correspond to the postulates formulated by the Institute for Sustainable Development and experts from the European Commission. The ratio of new green jobs to all new jobs created in the national labour market or registered unemployment rate can be a national indicator. The effect of green jobs on the unemployment rate is confirmed, for example, by Eurostat statistics.

Conclusions

There is a need for quantitative indexing using relatively simple information and diagnostic tools for developing new paradigms. At present, the indicators no longer require more justification, and the premises of Polish research on the measurement of sustainable development are very close to the motives of research in other countries. In addition, these indicators serve the implementation of international environmental and environmental management and social, economic and environmental governance in such a way as to ensure a high quality of life by respecting the principle of intergenerational justice and the principle of sustainability not only for the natural environment. This article points out the economic importance of green jobs as a new indicator for assessing sustainable development and precisely defining what is a green job category based on the Polish PKD.

The proposals presented in this paper have revolved around two main themes; green economy and New Public Management that have normative, operational and monitoring roles for green jobs. Based on them it is possible to consider the ways to strengthen the framework for sustainable development. While economic wealth is an important measure of sustainable development from the capital perspective, it cannot stand alone. It must be supplemented to form a practical and complete indicator set.

Presented in this paper green jobs are not intended as an international recommendation, but as a research proposal worthy of consideration by countries interested in finding a conceptually clear and defensible basis for indicators of sustainable development that is focused on long-term well-being.

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SUSTAINABLE DECOMMISSIONING AND INTEGRATED CLOSURE PLANNING OF SELECTED MINE SITES IN THE BICOL REGION, PHILIPPINES

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ABSTRACT

The study assessed the status of the Rapu-Rapu Minerals, Incorporated (RRMI) and the Filminera Resources Corporation (FRC) which are the polymetallic and mineral mining sites, respectively in the Bicol Region, Philippines regarding their mine closure and decommissioning procedures in relation to the impact communities that they engaged. It is in this context that the study was implemented to set a management direction in the inevitable event of mine closure and decommissioning. The study utilized the qualitative and quantitative methods of research. Respondents consisted of the key officials of government agencies and municipal and barangay officials as well as households of the host and impact communities covering the two mining sites of Rapu-Rapu and Aroroy as well as community organizations and mining company representatives. Findings showed that both mining sites extract similar resources and have been paying taxes to the Philippine government. Although the RRMI has initiated its mine closure process, decommissioning is underway and still needs to undergo its standard procedure with various stakeholders, while FRC has its operations ongoing. It is recommended that mine closure planning must be integrated within the overall mine operations plan, and should be integral to the operational life cycle of the mine sites.

Keywords: integrated closure planning; sustainable decommissioning

Introduction

The Philippine mining industry had a long mining history beginning with the Spanish colonial period. The first recorded corporate mining activity began in 1902 during the American colonial period in Northern Philippines. Historically, mining has been associated with the plunder of other natural resources such as forest resources because of the need for timber in underground mines. The Philippine mining industry enjoyed a boom in the 1960s and 1970s when the country became the world's 7th largest producer of gold and 10th largest producer of copper. However, the industry suffered a decline from the 1980s. When the Mining Act of 1995 was passed into law, a slight spike in equity investments occurred. However, strong opposition from the Church and civil society organizations created uncertainties among investors. In 2000–2004, the mining sector's contribution to exports declined to 1.7 percent annually (Risk Asia Consulting 2006).

Mining industries in the Philippines is one of the biggest contributors in government's revenue (taxes) yet it cannot also be denied that it has caused long term environmental alteration and degradation as well as social impact which are evident once mine site operations have ceased (Limpitlaw 2004). This could be the result of mining legislation which failed to prevent or minimize the possible long-term effects on the environment on account of the mining operations and mine closure (Dalupan 2001). It should be noted that the Philippines is not unique to this predicament as some of the international mining community faces similar problems, particularly in the mineral and polymetallic industry. Most marginal mines worldwide have closed and never to be re-opened. In the Philippines, the number of operating mines has declined overall to a low of 25 today. This trend is particularly noteworthy because it clearly shows that while the mining industry in the Philippines declined, it has done so at a time of increased worldwide investment in exploration and mining elsewhere in the Asia Pacific region. This has been particularly true in Papua New Guinea and Indonesia. The number of abandoned non-operating mines has increased by 83 percent whereas the number of explored prospects and under development exploration properties has declined by 50 percent. The number of abandoned/non-operating mines is at a high and the number of explored prospects and those under development/exploration is at an all-time low. Hence, mine closure planning is very significant, which is a practice but is neither complete nor formalized for a large majority of companies (Peck 2005).

On this premise, the study was designed to assess the Rapu-Rapu Minerals, Incorporated (RRMI) which implements the Rapu-Rapu Polymetallic Project (RRPP) being managed by the Korea Malaysia Philippines Resources (KMPRI) and the Masbate Gold Project being managed by the Filminera Resources Corporation (FRC) mining sites in the Bicol Region with the hope of recommending policies for the sustainable decommissioning and integrated closure of mineral and polymetallic mining operations. Specifically, it seeks to find answers to the following objectives: (1) determine the status of mineral and polymetallic mines under study in terms of operational, economic and social aspects; (2) determine the views of stakeholder and community involvements in the decommissioning and planning phase towards mine closure; (3) identify closure legislation and policies to regulate the implementation of sustainable mine de-

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commissioning and closure practices; and (4) determine mining policies that may be recommended to ensure a sustainable decommissioning and closure of mineral and polymetallic mining operations in the Bicol Region.

Materials and Methods

The study was conducted in the municipalities of Rapu-Rapu and Aroroy, Albay and Masbate, Philippines. Specific study sites are the three direct impact barangays Binosawan, Malobago and Pagcolbon and three indirect impact barangays, namely Linao, Sta. Barbara and Tinopan. In Aroroy, Masbate, the barangays of Amoroy, Bangon, Puro, Syndicate, Panique, Capsay, Balawing, and Lanang are the direct impact area without any designated indirect impact barangays.

Desk reviews, field observations and qualitative and quantitative approaches in data collection was used. Both secondary and primary data sources were used. The primary data was obtained from a survey of selected households and key informant interviews (KII) of different stakeholders. The purposive sampling through a non-random technique in obtaining data was used which involved the identification and selection of individuals as participants due to certain qualities they possess. These qualities or criteria for their selection covered the tenure of their stay as common residents of at least 15 years, who willingly provided the information by virtue of their knowledge and experience, availability and willingness to participate, and the ability to communicate experiences or opinions in an articulate, expressive, and reflective manner. The respondents were either ordinary resident and/or are employees of the mining company.

The survey questionnaire used consisted of two parts; the first part covered the socio-demographic information, and the second part, dealt with the level of stakeholders' community involvement in the planning and operating procedure towards mine closure and decommissioning. A total of 30 randomly selected respondents per municipality, with a total of 60 respondents across areas were surveyed covering both direct and indirect impact barangays of the two mine sites to gather information. A total of 30 key informants which include two consultants, eight key officials of the mine company, 20 informants from direct and indirect impacts municipalities and barangay officials.

Secondary data sources include information from the attached agencies of the Department of Environment and Natural Resources (DENR) Regional Office No. 5 such as the Environment Management Bureau (EMB), the Mines and Geosciences (MGB), and the Office of

Table 1 Description of mining project during operation phase.

Basic Description	Rapu-Rapu Minerals Incorporated (MMRI)	Filminera Resources Corporation (FRC)
Location	Rapu-Rapu, Albay	Aroroy, Masbate
Geographic coordinates	13°10′27″N / 121°12′27″E	12°28′4″N / 123°23′46″E
Tenement	Mineral sharing production agreement and mining patents approved in 1998, 2000 and 2004 with an area of 4,663 hectares	Mineral sharing production agreement – 289.9466 hectares; mining lease contract – 108 has. and patented mining claims – 236 has. in 1997.
Tenement Holder	Rapu-rapu minerals incorporated (MMRI)	Filminera resources corporation (FRC)
Permits Approval/ Secured	Partial declaration of mining project feasibility study	Declaration of mining feasibility in 2006
Major Stakeholder	Lafayette NL represented by Roderick Watt – country manager	Thistle mining Corp. Canada/South Africa Gerri Maritz Kennedy/Andreas Johannes Graetz
Foreign Partners	Lafayette NL Australia, LG Collins and KORES of South Korea	B2Gold Corporation of Canada
Commodity	Copper, gold, silver and zinc	Chromite, copper, gold, nickel and silver
Geology and Mineralization	Project area is underlain by schist that contain massive polymetallic sulphides consisting mainly of pyrite, with lesser amounts of chalcopyrite and sphalerite	Gold deposits are centred on a northwest-to-south east mineralized volcanic belt, 5–7 km wide, bounded by two northwest-trending fault zones
Reserves	Project has a reserve of about 5.9 Million MT @ 1.2% Cu; 2.5 g/t Ag & 2.1% Zn	48,000,000 MT @ 1.30g/t Au with a gross value of US$ 738 million
Production Rate	Annual production rate is placed at 10,000 MT for Cu; 50,000 oz. for Au; 14,000 MT for Zn and 60,000 oz. for Ag	Daily production of 17,123t milled. Mine produced 155,000 oz. Au in 2012 and to produce 200,000 oz. Au in 2013
Mine Life	Estimated at 7 years	Estimated at 12 years
Financial Details	Estimated to have a potential investment of US$42 million and potential gross sales of US$ 41 million/year. Potential estimated at US$ 0.80 million/year Excise tax due to the Philippine government (without incentives) and Potential Income Tax of US$ 5.7 Million/year (without incentives)	Potential investment US$ 45 million and potential gross sales US$ 62 million per year. Potential Excise Tax due to the Philippine government US$ 1.2 million per year (without incentives) and Potential Income Tax US$ 7 million per year (without incentives)
Potential Employment	1,000 during construction and 274 during operation	2,500 during construction and 300 during operation

Source: Mines and Geosciences Bureau – DENR.

Municipal Planning and Development (MPDO) in the Municipalities of Aroroy, Masbate and Rapu-Rapu, Albay. Descriptive statistics such as frequency count and arithmetic mean were employed to analyse the relevant datasets.

Results and Discussions

Operational, economic and social status in the project site

The information on the status of the mine sites in terms of operation was acquired from the Mines and Geosciences Bureau (MGB) of the Department of Environment and Natural Resources (DENR) Regional Office V. Table 1 presents the basic descriptions of the two mining projects on their operational stage.

Findings showed that both mining companies extract similar mineral resources such as copper, silver and gold that employs the same methods of extraction which is the open pit mining to extract the ore at a maximum annual rate of one million tons and contributed greatly to the employment and economic wellbeing of the people. However, in terms of mine life, RRMI is at the closures stage while FRC is still on its commercial operations.

The production data of RRMI covering the period CY 2012 to 2013 is presented in Table 2. The company produced 82,533.58 dry metric tons (DMT) of copper concentrate valued at P3,059,559,085.36 over a period of two years (2012–2013); 55,254.41 DMT of zinc concentrate with a value of P 1,333,839,457.21; 1,875.34 kg of Gold valued at P 3,838,878,808.16 and 27,912.18 of Silver valued at P 853,103,301.99. It should be noted that the end of the mine life for RRPP was November 16, 2013. It can be gleaned from the data that apart from copper, there was a decrease in terms of production for the year 2013 for the other minerals compared to year 2012 production.

Table 2 Production of RRMI, CY 2012–2013.

Commodity	Unit of Measure	Quantity (kg)	Estimated Value (Pesos)
copper concentrate			
2012	DMT	38,312.77	1,547,378,215.91
2013	DMT	44,220.81	1,512,180,869.45
Total		**82,533.58**	**3,059,559,085.36**
zinc concentrate			
2012	DMT	27,871.77	670,914,208.73
2013*	DMT	27,382.64	662,925,248.48
Total		**55,254.41**	**1,333,839,457.21**
gold (by-product of copper)			
2012	kg	990.77	2,128,424,996.11
2013	kg	884.57	1,710,453,812.05
Total		**1,875.34**	**3,838,878,808.16**
silver (by-product of copper and zinc)			
2012	kg	17,308.95	549,934,247.74
2013	kg	10,603.23	303,169,054.25
Total		27,912.18	853,103,301.99

Source: Mines and Geosciences Bureau – DENR.

In the case of the FRC/Philippine Gold Processing and Refining Corporation, production is limited to two most important mineral resources; gold and silver during the study period (2012–2014) (Table 3). A total of 17,057.31 kg of gold valued at Php 34,028,348,876.40 and 12,545.35 kg of silver valued at Php 431,663,769.50 were produced from year 2012–2014. It is noteworthy to mention that the gold produced in terms of volume is within the *not more* 5,000 kgs (5,499.97–5,949.29). However, there was a slight decline for silver in terms of production from 4,514.44 kg and 4,213.37 kg in 2012 and 2013, respectively to about 3,817.54 kg in 2014. This in turn has also dropped a bit in terms of its estimated value from Php 190,659,125.53 in 2012 to Php 103,411,807.91 in 2014 (Table 3).

Table 3 Production of FRC/PGPRC, CY 2012–2014.

Commodity	Unit of Measure	Quantity (kg)	Estimated value (Pesos)
gold			
2012	kg	5,949.29	13,418,662,378.90
2013	kg	5,499.97	10,518,224,761.09
2014	kg	5,608.05	10,091,461,736.41
Total		**17,057.31**	**34,028,348,876.40**
silver			
2012	kg	4,514.44	190,659,125.53
2013	kg	4,213.37	137,592,836.06
2014	kg	3,817.54	103,411,807.91
Total		**12,545.35**	**431,663,769.50**

Source: Mines and Geosciences Bureau – DENR.

Based from the monthly project update report of RRMI and FRC, huge amount of taxes were contributed by both mining companies. For instance, from 2012 to 2014, RRMI contributed to the Philippine government a total revenue of Php 1,003,084,002.45, both in the national and local taxes, while FRC contributed a total amount of Php 2,403,093,440.08 from both national and local taxes for the past three-year duration. This is in accordance with the government share allocated in accordance with Sections 290 and 292 of Republic Act No. 7160 otherwise known as the Local Government Code of 1991. Specifically, the share of local government units (LGUs) in the proceeds in the national taxes shall be forty percent (40%) of the gross collection derived by the national government from the preceding fiscal year from mining taxes, royalties, forestry and fishery charges, and such other taxes, fees, or charges, including related surcharges, interests, or fines, and from its share in any co-production, joint venture or production sharing agreement in

the utilization and development of the national wealth within their territorial jurisdiction, in addition to the internal revenue allotment per Sec 290 of RA. 7160. On the other hand, Section 285 of RA. 7160, stipulates that the internal revenue allotment shall be collected in the following manner (a) Provinces – 23%; (b) Cities – 23%; (c) Municipalities – 34%; and (d) Barangays – 20%. This shall be determined on the basis of the following formula: (a) Population – 50%; (b) Land Area – 25%); and (c) Equal sharing – 25%.

Despite the huge amount of taxes from the share of the government's revenue taxes, it appears that the general economic condition in the host communities are still low. Although the RRMI, it has contributed to the employment of more or less 21.5% (3,413) to the local population in 2010, while FRC contributed employment to about 8.13% (14,927) of the local population in the same year, the socio-economic development in the mine sites appears to be problematic. For instance, in RRMI impact barangays, one in ten persons finished grade school and three out of ten are elementary undergraduates. Seven out of 100 graduated from high school and three out of 100 have graduated and earned academic degrees from college. The drop-out rate from elementary to high school is estimated at 90%. The Rapu-Rapu National High School in Barangay Poblacion is the only accessible secondary school in the island. Survey result attributes the high incidence of poverty and the absence of an accessible secondary school in the area as the culprit. As such, it deprives the islanders for better opportunities in the future. The attribution of poverty incidence is supported by the report of National Statistical Coordination Board (NSCB) that poverty incidence in mining areas is generally higher than the national mean (of 24.7 percent) as of 2003. As a matter of fact, the top most gold and copper producing provinces of the country, namely, Camarines Norte, Masbate and Agusan, are among the areas with highest poverty levels in the country. In addition, World Bank and International Finance Corporation (2002) as cited by SEPO (November 2005) reported that mining has contributed very little to the alleviation of poverty. It should be noted that proceeds from the share of LGUs' should be appropriated by their respective Sanggunian to finance local government and livelihood projects. From these observations, it could be inferred that the share of LGUs has not been appropriated properly and the capacity of LGU in implementing poverty program is weak, in particular in to reducing the problem in education to the minimum.

In FRC host barangays, nearly half or 48% have attended or completed elementary education. The high school undergraduates constitute 20%; those who completed secondary education are 10%; college undergraduates constitute around 4% and those with academic degrees are only 3%. Apparently, these were attributed to the government's effort that provided complete school facilities from elementary up to college. Aroroy, Masbate is a 1st class municipality in the 2nd District of the province of Masbate. More females finished college than their male counterparts. It is also interesting to note that in RRMI areas, people put much priority on livelihood benefits, while in FRC areas, health services is given much priority (Kearns and Barnett 1998).

When asked regarding the benefits derived from mining operations, 86.7% from the RRMI areas claimed that the mining operations have given them livelihood (i.e. fishing paraphernalia, funds for animal raising and farming), 76.7% health services and 73.3% claimed to benefit from sponsored social projects. The mining company granted them livelihood assistance as part of the Social Development and Management Program (SDMP) commitment of RRMI to the impact barangays (Table 4). In FRC areas, benefits derived were in the order of health services (83.3%), educational benefits (76.7%) and income from mining employment (73.3%). It is noteworthy to mention that these benefits were those contributed to the respondents and not from the proceeds of the government share collected by LGUs.

When asked whether they are aware of the mine closure in the next three to ten years, results obtained showed that 86.7% and 70% of respondents from the both mining site barangays responded positively (Table 5). This is due to the various meetings and consultations conducted by the concern mining company in the impact barangays and through a wider dissemination by word-of-mouth relative to the expected mine closure. Added to this is the fact that the mine is currently on its closure stage, and most of the residents are already aware of this.

Table 4 Benefits derived from mining operations**.**

Responses	RRMI Barangays		FRC Barangays	
	F	%	F	%
Livelihood benefits from mining company	26	86.7	19	63.3
Income from work in the mine site	14	46.7	22	73.3
Educational benefits for children	20	66.7	23	76.7
Health benefits from health services	23	76.7	25	83.3
Benefits from sponsored social projects	22	73.3	20	66.7

(N = 30 respondents/mining sites)

Stakeholder's views and community involvements in the decommissioning and planning phase towards mine closure

In the aspect of stakeholder views and community involvements relative to mine decommissioning and closure planning, various consultations were undertaken in the formulation and preparation of the Social Development and Management Program (SDMP) in the two mining sites. A chi-square test ($\chi^2 = 32.42$, $p < 0.001$) indicated that the respondents' perception on the current mining operations differ in the two locations. Respond-

ents from FRC barangay more likely to show that the current mining operations provided family's income source while the RRMI respondents perceive it to be the source of community projects. This further validates the situation with RRMI areas as the company has commenced in closing mining operations, where only the social projects on account of the SDMP are the ones benefiting the communities, while income from mining operations are the ones obtained by the residents of FRC barangays.

Table 5 Respondents awareness on mine closure in the next 3 to 10 years.

Responses	RRMI Barangays		FRC Barangays	
	F	%	F	%
Yes	26	86.7	21	70
No	4	13.3	9	30
Total	30	100	30	100

(N = 30 respondents/mining sites)

In RRMI impact barangays, the communities were involved in the formulation of the plans for livelihood and employment as a result of the closure of the mining project. Under the SDMP scheme, fishing implements (i.e. banca, nets and fishing gears) were provided; funding opportunities to implement piggery, poultry and goat raising projects; provision of agricultural inputs for coconut, abaca and vegetable production; organization of cooperatives and the recovery of scrap materials for community projects were also included in the package. It also made possible the provision of water system such as storage tanks and water distribution lines, educational assistance in the form of scholarships for pupils and students, provision of electricity, health services and the conduct of medical missions. The maintenance of road networks, environmental conservation and preservations measures were also part of the major provisions of the SDMP for the impact barangays. These are the social services which people source out on account of the mining operations, which is why for them these things are very favourable as, reflected in Table 6.

Comparatively, the SDMP provisions for the FRC impact barangays consists of allocation for environmental safety features with conservation and preservation measures along tailings impounding areas; establishment of community mangrove reforestation and aquaculture projects; establishment of cacao plantation; conversion of the current airstrip into a municipal airport; development of ecotourism.

Table 6 Reasons why people favour mining.*

Responses	RRMI/RRPI Barangays		FRC Barangays	
	Frequency	%	Frequency	%
Source of social services for residents	23	76.7	21	70.0
Source of community projects	21	70.0	20	66.7
Source of income	15	50.0	23	76.7
Offer business opportunities	13	43.3	19	63.3
Source of patronage	12	40.0	18	60.0

* Multiple Response

In the municipality; conversion of the building facilities inside the FRC compound to a residential area; development of causeway for commercial operation to accommodate cargo of large vessels; development of an agro-forestry site out of the tailings storage and mill facilities; conversion of the mine power plant into an independent power provider; turnover of the management of the division dam to a local cooperative; maintenance of access roads; and the relocation of the church into a new site.

Closure legislation and policies for sustainable mine decommissioning and closure practices

Mine closure legislation and policies which regulates the implementation of sustainable mine decommissioning and closure practices adopted and implemented by mining companies are clearly stipulated and embedded in the final mine rehabilitation and decommissioning plan (FMRDP). Such plan is in accordance with Republic Act No. 7942 otherwise known as the "Act Instituting a New System of Mineral Resources Exploration, Development, Utilization and Conservation". This act emphasizes that all mineral resources in public and private lands within the territory and exclusive economic zone of the Republic of the Philippines are owned by the State. It shall be the responsibility of the State to promote their rational exploration, development, utilization and conservation through the combined efforts of government and the private sector in order to enhance national growth in a way that effectively safeguards the environment and protect the rights of affected communities. In Section 85 under Chapter XV of this act, it implies that a semi-annual fee to be known as mine wastes and tailings fee is hereby imposed on all operating mining companies in accordance with the implementing rules and regulations. The mine wastes and tailings fee shall accrue to a reserve fund to be used exclusively for payment for damages such as but not limited to rehabilitation of silted farm lands and other areas devoted to agriculture and fishing caused by mining pollution; Administrative Order No. 2010–21, which provides for a Consolidated Department of Environment and Natural Resources (DENR) Administrative Order for the Implementing Rules and Regulations of Republic Act No. 7942, otherwise known as the "Philippine Mining Act of 1995"; DENR Administrative Order 2005–07, which are the "Amendments to Chapter XVIII of DENR Administrative Order 96–40, as amended, providing for the establishment of the Final Mine and Decommissioning Fund"; Administrative Order No. 2010–21, which provides for a Consolidated Department

of Environment and Natural Resources Administrative Order for the Implementing Rules and Regulations of Republic Act No. 7942, otherwise known as the "Philippine Mining Act of 1995"; DENR Administrative Order 36, Series of 2004, which revises the DENR Administrative Order No. 29, Series of 1992, to further strengthen the implementation of Republic Act 6969 (Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990) and Prescribing the Use of Procedural Manual; DENR Administrative Order No. 1996–40, as amended, it specifically provides the guidelines on the determination of a post-mining land use and shall adhere to the principle of sustainable development which meets the need of the present without compromising the ability of the future generations to meet their own needs, with the view of improving the total quality of life, both now and in the future.

The development of a sustainable mining industry is dependent on the development of a regulated and controlled responsible mining industry. However, appropriate legislation and policies should be developed to effectively control and regulate mine closure process within the initial mine assessment and approval process (Clark et al. 1998). Based on the findings of the study, it can be construed that the contribution of mining to the overall economy of the two municipalities is relatively small considering the fact that in case of decommissioning and closure, the local community is directly affected. Hence, an equitable sharing mechanism should be developed so that the host communities may have the highest share, a reverse of the present sharing scheme based on RA 7160. Citing data from the Mines and Geosciences Bureau (MGB), the mining sector currently has a 0.7 percent contribution to the country's gross domestic product (GDP) and comprises 5.6 percent of the total exports of the Philippines. One critical use of the mineral accounts is in the analysis for an appropriate fiscal policy considering its small contribution to the economy and the contentious debate on mining and its links with issues on land-use, environment and social acceptability. In terms of the proposed use of mine facilities and equipment's after mine closure and the suggestions for a sustainable mine closure and decommissioning program in the mining sites, Table 7 and Table 8 reflects the respondent's views, respectively.

Table 7 Suggested use of facilities after closure.

Responses	RRMI Barangays		FRC Barangays	
	F	%	F	%
School complex	19	63.3	20	66.7
Sports complex	16	53.3	15	50
Camp site	21	70	23	76.7
Housing complex	18	60	19	63.3
Tourist destination/ attraction	22	73.3	24	80

(N = 30 respondents/mining sites)

Table 8 Suggestions for a sustainable mine closure and decommissioning program.

Responses	RRMI Barangays		FRC Barangays	
	F	%	F	%
More participation in meetings and discussions	20	66.7	27	90
Clear cut policies are provided for the program	25	83.3	26	86.7
Transparency should be observed in all aspects	24	80	25	83.3
Facilitate release of funds for social projects	28	93.3	29	96.7
Participatory planning and implementation of program	27	90	24	80

(N = 30 respondents/mining sites)

The expectations from the Local Government Unit (LGU) to achieve a sustainable mine closure and decommissioning plan or mechanism was also asked and majority of the answers of the respondents covering the two mining sites focused on the coordination with various stakeholders, to assist and support the closure planning process and the prioritization of the SDMP projects as reflected in Table 9. Although these were emphasized prior to the FMRDP, some respondents however, may not be familiar of the rightful process for the sustainable closure and decommissioning but are aware of how things can be properly managed.

Table 9 Expectations from LGU to achieve the sustainable mine closure/ decommissioning.

Responses	RRMI Barangays		FRC Barangays	
	F	%	F	%
Assist and support the planning process	15	50	20	66.7
Asserts that mine company follows the law	9	30	12	40
Prioritize SDMP projects from mining company	18	60	15	50
Participates in the process	17	56.7	19	63.3
Coordinates with various stakeholders	20	66.7	23	76.7

(N = 30 respondents/mining sites)

Conclusions and Recommendations

Assessment result showed that both Rapu-Rapu and Aroroy mining sites are compliant with the provisions of the Philippine Mining Act 1995, wherein both the mining companies follows the prescribed implementing rules and regulations as stipulated on the said Act. Likewise, practices regarding mine closure were adopted by both mining companies which are clearly stipulated and embedded in the final mine rehabilitation and decommissioning plan (FMRDP). However, much has to be desired

in terms of stakeholder participation and community engagements for sustainability at the start of planning for operations to have a proactive perspective for the future mine decommissioning and closure. In the case of RRMI, while it has complied with the minimum requirements cited in the legal provisions, such are not sustainable in terms of economic and social continuity. This is because, what has been laid down at the outset, prior to the closure phase primarily focused on the SDMP project planning and implementation and not much on the decommissioning aspects. This features how the structures and facilities will be able to serve in favour of the impact communities directly and indirectly affected by mining. Facilities and infrastructures built to support the mining operations is worth millions of pesos, yet lesser community interventions were undertaken to pave way to their involvement, participation and decisions.

It is therefore recommended that the following mining policies to achieve a sustainable decommissioning and closure be made: 1) The development programs as an output of the consultations and legal processes implemented to establish the SDMP of the impact barangays should be integrated as a development roadmap subject of the LGUs for regular review, monitoring and evaluation; 2) Mine closure planning must be integrated within the overall mine operations plan, and should be integral to the operational life cycle of a mine to include: (a) Mine Closure Planning at the feasibility phase of mine operations, which allows mining operations to identify future constraints and costs of mine closure; (b) Financial provisions and assurances; (c) stakeholder engagement and community consultation needs to be integrated within the overall mine operations and closure processes; (d) clear and measurable indicators are needed to track compliance; 3) The organizational transformation of the DENR, specifically the MGB and the EMB of the DENR, where a regulatory structure should be rationalized. Currently, the MGB is under the DENR, as well as the EMB. The research strongly recommends for the creation of another government agency like the Environmental Protection Agency (EPA), where the function of which should focus on the Regulatory, Monitoring and Evaluation of mining and other industries' operations and activities, and for which the EMB should be a part. A specialized Bureau, like a Mining Regulatory Authority, that will regulate mining practices, policies and procedures compliant to the Mining Act of 1995 and other legislative policies and protocols. Consequently, the regulatory body should also employ the services of soil scientists as part of the regulatory functions on hazardous wastes brought about by mining operations, or in close collaboration with, but not limited to, the Bureau of Soils and Water Management and with the Department of Agriculture to help ensure sustainability of resources. These recommendations can be integrated into a manual for the regulatory agencies, like the DENR to ensure sustainability in the mining activities, specifically covering the final mine decommissioning and closure planning.

Future studies on the equitable distribution of taxes paid by the industry to ensure the greatest possible benefit for the host community who in most case suffer from the consequences of environmental alteration and modifications from mining industry is highly recommended. Likewise, study on people's priority must be conducted in host communities to properly determine where to concentrate in terms of the corporate social responsibilities of the mining companies.

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SETTING THE GROUNDS FOR THE GREEN INFRASTRUCTURE IN THE METROPOLITAN AREAS OF ATHENS AND THESSALONIKI: THE ROLE OF GREEN SPACE

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ABSTRACT

Green Infrastructure (G.I.) is a *sine qua non* in contemporary planning. Green spaces can play a vital role in serving as grounds for developing G.I. and promoting environmental, social and economic benefits.
In Athens and Thessaloniki (the only metropolitan areas in Greece) there has been no Green Infrastructure planning. However, existing and prospective green spaces can play a catalyzing role in the development of a Green Infrastructure. In fact, even though inadequate and insufficiently dispersed, urban green spaces present great potentials for embedding the features of "green", "connectivity", "multi-functionality" and "accessibility", which are key to G.I. planning. The concept of Green Infrastructure has long been embedded in policy documents, such as the Master Plans of both metropolitan areas. And even if the G.I. term is not clearly stated in either Master Plans, there is a clear goal for the designing and networking of green spaces, to provide leisure opportunities and other functions, as well as accessibility to all citizens.

Keywords: Athens; environmental planning; Greece; Green Infrastructure; green spaces; Thessaloniki

Introduction

Green Infrastructure

The Green Infrastructure concept gained momentum in planning theory and practice after the 1990s, initially in the United States and then in the European Union (Naumann et al. 2011; Lennon 2015). According to the EC (COM/2013/0249 final), Green Infrastructure is defined as:

"A strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services. It incorporates green spaces (or blue if aquatic systems are concerned) and other physical features in terrestrial and marine areas. On land, Green Infrastructure is present in rural and urban settings."

Although Green Infrastructure is a new term, some scholars believe that it is not a new idea. They think that Green Infrastructure planning goes back to the 19th century, when green areas were designed to offer recreation opportunities to urban populations, as well as to resolve public health and flooding problems (Benedict and McMahon 2002; Mell 2008). Others (Amati and Taylor 2010; Thomas and Littlewood 2010) think that Green Infrastructure is connected to the long-established green belt concept (originally found in the UK planning system), or that it was embedded for the first time in the famous 1947 Finger Plan of Copenhagen. According to other scholars however, the G.I. concept is related to a more recent concern: that of habitat fragmentation observed in natural ecosystems (Sandström 2008; Karhu 2011).

Regardless of the concept's origin, Green Infrastructure is not only a tool, addressing environmental theory. It is also a planning tool, concerning socio-economic policy (Wright 2011). However, as Kambites and Owen (2006) argue, translation of "Green Infrastructure thinking" into "Green Infrastructure planning" (i.e. turning the G.I. concept into planning implementations), requires a certain (planning) framework, with the key aspects being: the planning scale, the G.I. components, the features embedded and the functions provided.

Regarding the planning scale, Green infrastructure can be designed at very different scales as many scholars argue, ranging from the urban and local level to a pan-regional scale (City Parks Forum 2003; Benedict and McMahon 2006; Mell 2010; Lafortezza et al. 2013). Despite this wide range however, preferences exist. The City Parks Forum (2003), for example, suggest that Green Infrastructure should be debated on a larger scale due to the benefits of climatic and landscape resource management. The use of a transboundary scale is also supported by De Sousa (2003), Selman and Knight (2006) and Kambites and Owen (2006). Lafortezza et al. (2013) on the other hand, support another option, also adopted in the present paper, that the city region scale, including the urban conurbation along with its adjacent wild-land urban interface, appears to be the most suitable scale for planning Green Infrastructure.

Regarding the G.I. components, these are mainly two (Benedict and McMahon 2002): the "hubs" and the "links". Hubs constitute "anchors" for the services that the GI concept supports and includes reserves, parks and open spaces, residual lands, forests and farmlands, woodland, outdoor sports facilities, allotments, urban farms, etc. as well as all other types of urban open spaces (Benedict and McMahon 2006; Davis et al. 2015 etc.). At the regional (landscape) scale, "hubs" may also include protected areas and restoration zones (Naumann et al.

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2011). Links on the other hand, constitute the connections between "hubs" and may include green corridors and green belts (Williamson 2003), taking also advantage of several networks ("grey" or not), such as hydrology, transportation, energy (Rouse and Bunster-Ossa 2013) or aquatic elements (Abbot 2012).

Regarding the features with which Green Infrastructure is mainly associated, Wright (2011) identifies the underlying features "connectivity", "multi-functionality" and "green" as the core ideas of Green Infrastructure, with the notion of connectivity (networks) highlighted the most. Indeed, Jongman and Pungetti (2004), Opdam et al. (2006) and Silva et al. (2010) describe Green Infrastructure as "ecological networks" primarily related to landscape ecology. Little (1990) and Fàbos (2004), put the emphasis on recreation and leisure ("greenway networks"), with the attribute "multi-functionality" also mentioned by Thomas and Littlewood (2010), Rouse and Bunster-Ossa (2013) etc. "Connectivity", as a general feature, is stressed by Kambites and Owen (2006), whilst the feature "green" is emphasized by Rayner et al. (2010) and Williams et al. (2010). Other attributes characterizing G.I. in the literature are: "accessibility", "interdisciplinarity", "inclusiveness" "resilience", "social cohesion", "territorial cohesion", etc. (Benedict and McMahon 2006; Kambites and Owen 2006; Naumann et al. 2011; Lovell and Taylor 2013).

Developing G.I. can be beneficial for a city or a landscape in many ways. According to the literature, Green Infrastructure can contribute to: climate change adaptation, landscape protection (Kambites and Owen 2006), ecological conservation (Marcucci and Jordan 2013), recreation and education facilitation (Erickson 2006; Mell 2010), aesthetic enhancement (Pincetl 2013), social and economic revitalization (Thomas and Littlewood 2010), regeneration and urban growth (Mell 2010), storm water management (Abbot 2012), urban runoff mitigation and heat island reduction (Newell et al. 2012).

Given the above benefits, the current paper aims to discuss issues of Green Infrastructure planning in Athens and Thessaloniki, which constitute the two metropolitan areas of Greece; i.e. vast built-up areas that lack of open spaces, in which the need to embed the G.I. concept in to their planning is much higher, so that climate change effects as well as the fragmentation of the natural ecosystem are addressed. The ultimate scope of this paper is to discuss the problems and perspectives of using existing green spaces for the development of G.I. in the two metropolitan areas taking into consideration the current economic conditions and the permanent threat of urban sprawl and climate change.

Urban green spaces and their role in Green Infrastructure planning

According to the U.N. WHO (World Health Organization), urban green spaces are "any vegetated areas of land or water within or adjoining an urban area", such as parks, sports fields, woods and natural meadows, wetlands or other ecosystems. According to Swanwick et al. (2003), "green space" consists of predominantly permeable "soft" surfaces, such as soil, grass, shrubs, trees and water. The term urban green space is often used interchangeably with "open space", giving rise to confusion. According to the United States Environmental Protection Agency (EPA), "open space" is defined as "any open piece of land that is undeveloped (has no buildings or other built structures) and is accessible to the public". As such, "open spaces" include: green space, schoolyards, playgrounds, public seating areas, public plazas, vacant lots etc.

Depending on their location, urban green spaces may be divided into two elementary types: a) green spaces within a city and b) green spaces found in continuity or in the vicinity of a city that usually include areas of forest or other types of vegetation. Whereas green spaces in a city are physically constrained due to the limitations of the urban environment, green spaces in the surroundings, because of their size, provide a significant proportion of a city's population access to green space and therefore they are often of supra-local importance. As several scholars argue (Beriatos 2002; Allen 2003), green spaces in the surroundings of a city serve as "green walls" [for the (environmental) protection and shielding of a city].Thus they are as important as those within the city, not only in the case of small or medium-sized towns but mostly in the case of large urban centers and particularly the metropolises, where usually the need for green spaces is much greater.

Green space coverage and allocation differ significantly among urban areas. There is a set of factors that determines the differences between cities, which are usually related to (Fuller and Gaston 2009): (i) the history of city planning (e.g. cities with extended medieval cores, planned or organically developed areas); (ii) the productive model of a city (for example industrial or tourist-led city); (iii) institutional and social parameters that are related to land ownership; (iv) unforeseen events, such as earthquakes or other natural or man-made disasters that made possible major urban planning interventions; as well as (v) environmental conditions (climate type, land terrain, water existence). Whereas the majority of cities in northern and northwestern Europe have been characterized by an increased per capita green space allocation, cities in the south and east of Europe lag behind to a large degree in terms of the per capita green space coverage. Greek cities, characterized by a very compact urban form, have the lowest green space availability per inhabitant, ranging between 2 and 10 square meters per capita (Fuller and Gaston 2009).

Green spaces within a city and in its surroundings constitute a key parameter in Green Infrastructure planning. They constitute crucial "hubs" that are by nature designed to include the feature "green" (which is of prime importance to G.I.). They also serve as air-cleaning filters, improve the microclimate, foster biological diversi-

ty, mitigate city noises and other nuisances, reduce the risk of floods, serve as leisure and recreation venues for social interaction, contribute to upgrading the urban landscape, and also function as gathering areas in case of natural disasters and emergencies (Benedict and McMahon 2002; Gill et al. 2007).

In short, urban green spaces, inside the city and in its surrounding area, existing and prospective, play a significant role in the environmental planning and management and are a significant factor for enhancing the quality of life in a city. However, in an era of unprecedented urban sprawl and climate change, green spaces have to be not only physically designed but also functionally incorporated into urban uses and functions, to provide more environmental, social and economic benefits to the city. In other words, urban green spaces should be properly and adequately planned, in order to serve the development of G.I. in a city or urban agglomeration.

The Case Studies of Athens and Thessaloniki

Methodological framework

The present section deals with the metropolitan areas of Athens and Thessaloniki, for which a two-fold analysis is given. Firstly, the current situation and adequacy of green spaces is presented and secondly, the environmental planning philosophy (as expressed in their Master Plans) is described and then discussed in terms of embedding the G.I. concept.

Green spaces, which are *de facto* designed to embed the feature "green", are evaluated in terms of adequacy and dispersion, as well as for embedding important features of the G.I. concept, such as "multi-functionality", "connectivity" and "accessibility". Master Plans also need to embed the same key G.I. features, having the following context:

- "**green**": referring not only to vegetation but to the blue (aquatic) element as well and to a highly ecological dimension (Lafortezza et al. 2013);
- "**networking**"/"**connectivity**": which is about the interlinking of green spaces (and other "hubs") in a functional and physical way (Davies et al. 2015), to ensure biodiversity, ecosystem services, adaptation to climate change, green economy, human health, social cohesion, etc.;
- **"multi-functionality"**: referring to recreation and leisure, education, exercise, economic development, mobility, health and human well-being (Mell 2010);
- **"accessibility"**: having to do with the unimpeded access of all citizens – privileged and non-privileged, disabled or not (Ross 2000) to green spaces and the benefits they offer.

The analysis of both case studies builds upon already existing (though fragmented) research studies on the green spaces in the two metropolitan areas (elaborated for the Ministry of the Environment and other competent Institutions). The originality of the research lies in the fact that so far, no research on the incorporation of G.I. in planning exists in Greece. Currently, there is little literature on G.I. in this country and it mainly discusses a few cases and the implementation perspectives at the neighbourhood scale (Karanikola et al. 2016; Makropoulou and Gospodini 2016; Salata and Yiannakou 2016). Both cases (Athens and Thessaloniki) were chosen as they are the only metropolitan areas in Greece, i.e. they are urban agglomerations for which there is high priority for embedding the concept of G.I. due to the vast built up areas, which have resulted in extreme fragmentation of the natural ecosystem.

Key information on the green spaces in Athens

Athens is the capital of Greece. It is located in the central continental part of the country (Attica Region). Its metropolitan area has 3.8 million inhabitants, corresponding to almost 40% of the country's population and covers an area of 3,808 km².

The Athens urban agglomeration sprawls across the central plain of Attica and is surrounded by four mountains (Egaleo, Parnitha, Penteli and Himittos). The significance of these mountains as natural barriers against urban sprawl and as areas providing significant amounts of green was first recognized in the 1960s. It was then that Mount Parnitha was designated as a "Natural Park" and most of the other mountains as "Landscapes of Outstanding Natural Beauty". Since then, Protected Areas in the surroundings of Athens have grown significantly both in size and number, forming a continuous green buffer zone around the Athens Basin (Beriatos 2004). In addition to environmental legislation, protection of the suburban green and surrounding space became more feasible when three 'Zones for Urban Control'[1], were designated in the early 1990s. This means that even at that time, efforts to protect the capital's suburban natural space did not only concentrate on the "green" feature but also on safeguarding and development of multiple functions and economic activities, such as agriculture, leisure, etc. Despite this, Athens' suburban green spaces are constantly under threat of fire and urban sprawl. It is worth noting that between 1987 and 2007, 18,418 km² of suburban forest was converted to other types of coverage (such as built-up areas), while the fire of 2009 in northern Attica destroyed another 20,521 km² of land that was mainly covered with forest (WWF Hellas 2007, 2009).

On the other hand, green spaces within the city began to be created in the 19th century, initially to serve aesthetic purposes (Papageorgiou-Venetas 2016). Later, in the 20th century, green spaces in Athens kept increasing, either as part of urban planning implementations or of

1 'Zones for Urban Control' are applicable to only rural or suburban areas and impose building regulations to halt urban sprawl. The three 'Zones for Urban Control' that were implemented in the rural space of Athens, in the late 1990s served to protect the suburban green space, as a secondary objective.

more strategic projects and Plans, having in mind that Athens was gradually turning into a metropolitan city, with particular urban, economic, social and environmental needs.

Considered to be of particular importance for the Athens urban agglomeration are the metropolitan parks, i.e. extended green spaces of supra local importance, found within the urban agglomeration (such as Tritsis Park, Goudi Park etc). Although overall measurements of the size of these parks do not exist, it should be mentioned that most of them were created in the early 2000s, as part of the "Attica S.O.S." project that was launched in 1994 (Master Plan Agency 2002), aiming to set the basis for the formation of a green "grid" [2] in the metropolis and ultimately reach the standard of 5 m² green space/inhabitant (that was set in the 1980s). "Attica S.O.S." was the last project to be launched for the urban greening of Athens (also as a result of the ongoing economic recession) to provide extensive green and multi-functional spaces.

Today, even if a standard and complete analysis of the existing green spaces in Athens was undertaken (to have full and comparative data), there is no doubt that the metropolitan area lags behind in terms of green spaces. According to estimates based on the urban planning standards and the size of the metropolitan area, green spaces in the Athens Basin should amount to 35 km² (NTUA 2011). However, in the densely built-up metropolitan area in Athens, the reality is considerably different. Green spaces in the Municipality of Athens (i.e. the urban historical core of the city), hardly cover 0.4 km², which correspond to 2.8–3% of the municipality's surface area. This means that each citizen in the Athens Municipality has access to only 2–2.5 m² of green space. At the same time, even if all open spaces (i.e. abandoned and underused spaces) in the same area were converted to green, this value would only increase to 3.84 m² per inhabitant (Belavilas et al. 2012). A singular opportunity was missed when Athens became the host city for the Olympic Games in 2004. Excessive needs for sports facilities and arenas resulted in the permanent loss of large areas of open space, many of which were designated to become green space. This loss is estimated to correspond to as much as 1.23 m² of green spaces per inhabitant in the urban agglomeration (Belavilas and Vatavali 2009). Further to issues of adequacy, green spaces within the Athens metropolis are also unequally allocated. The proportion of green space is significantly lower in the urban core and the western part of the metropolis, as opposed to the suburban areas in the northern and southern parts (Belavilas and Vatavali 2009), where the more prosperous middle and upper classes of Athens' population reside.

To sum up, despite the fact that in Athens many green spaces of all sizes exist (especially metropolitan parks), the "green" element does not prevail within the urban agglomeration, nor is it equally dispersed, so that all metropolitans have access to it. In fact, development of green spaces within the city were constrained by a set of historical and political factors, resulting in habitat fragmentation (between the urban green and the natural ecosystem at the periphery), loss of biodiversity and a severe lack of spaces that would also offer opportunities for recreation, leisure and education. Suburban green on the other hand, even though it could compensate for this loss (due to its size and network formation), is constantly under threat from fire and (until recently) urban sprawl.

Key information on the green spaces in Thessaloniki

Thessaloniki, is the second largest city in Greece. Situated in the northern part of the country (Region of Central Macedonia), the metropolitan area of Thessaloniki has almost 1 million inhabitants and covers an area of approximately 400 km².

The northern part of the metropolitan area in Thessaloniki is surrounded by an extensive forest-park called Sheikh-Shou. It is an artificial suburban forest whose afforestation began by planting pine trees in an area of 0.04 km², right after the liberation of Thessaloniki in 1912. Since then a series of enactments (starting in the 1920s) resulted in a significant expansion of this suburban forest-park that by the 1990s covered up to 30 km². Due to its importance and size, in 1984 it was protected as 'Landscape of Outstanding Natural Beauty' and in 1994 it was designated as a 'Zone of Absolute Protection' (Stergiadis 2002). However, a fire in 1997 destroyed nearly 55% of the forest (Papastavrou 2002), resulting in continuous and ongoing efforts for its reforestation.

Apart from this forest-park, the network of suburban green spaces of Thessaloniki is complemented by the wetlands of the Axios River located on the western side and a large manmade Environmental Park in the east. The former was designated a "Natural Park" in 2009, while the latter serves as a recreation area covering a total area of 0.08 km². Another important "green" element in the suburban zone is the artificial Canal (total length of 8.3 km) that was constructed in the 1960s to prevent floods caused by rainwater run-offs coming down from Sheikh-Shou forest-park. From the beginning, it was designated a green zone to enrich the city's urban green. Today, an ongoing project for the readjustment of the canal's course is still the priority of the green zone (Master Plan Agency of Thessaloniki 2007).

The urban green spaces in Thessaloniki began to be formed in the late 19th century for aesthetic reasons, starting from the historic center of the city (Karadimou-Gerolympou 1995). Green spaces in Thessaloniki continued to flourish during the 20th century, having this time, however, a more ecological dimension. In Thessaloniki the amount of green space per capita is set at 8 m² (which is also the national standard that the Official Gazette No 285Δ/2004 sets for all Greek cities). As in

2 "Attica S.O.S." project was launched in order to facilitate the implementation of the first Master Plan of Athens, especially in respect to its environmental goals.

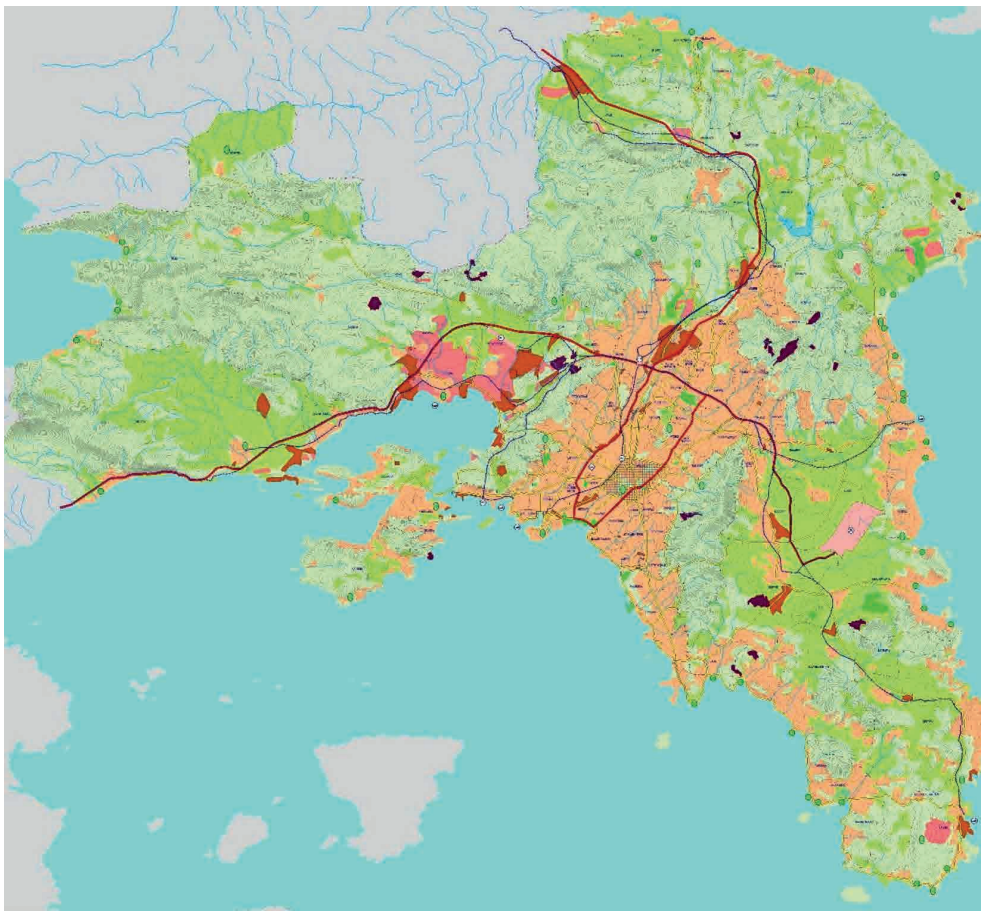

Fig. 1 Green spaces in the urban agglomeration and the peri-urban zone of Athens.
Source: Master Plan Agency of Athens (2002).

the case of Athens, in Thessaloniki too, responsibility for the achievement of this standard lies in urban planning implementations. In the recent past, of vital importance for the greening of Thessaloniki proved to be not only the enactment of the Master Plan but also the designation of the metropolis as "the cultural capital of Europe" in 1997. Back then, a series of projects were launched, which aimed to enhance and upgrade both the natural and the built-up environment of the city (Thoidou and Foutakis 2006; Karadimou-Gerolympou 2014). And even though most of these projects ended up providing green "city shots" (instead of extensive green spaces), at least they managed to offer better "accessibility" for the citizens to the urban green areas (given the dispersion of these green spaces) and some kind of "multi-functionality" (given also the cultural dimension of these urban regeneration projects).

The only available data on the green spaces in the metropolitan area of Thessaloniki are in a study conducted for the Master Plan Agency of Thessaloniki, which, however was not published. According to this study (conducted in 2006), in the metropolitan area of Thessaloniki the green spaces that are provisioned by spatial planning is 5.69 km² in the urban agglomeration, and 1.54 km² in the suburban zone. This means that, if suburban green is taken into account, green spaces in the metropolitan area of Thessaloniki account for 7.23 m² per capita, which is very close to the national standard (8 m² per capita). Indeed, the deficit in green spaces is estimated to be 13,600 m² of the total surface of the metropolitan area, which corresponds to only 16 m² per 1,000 inhabitants. Regarding the allocation of green spaces, the area is particularly low in the urban agglomeration (5.08 m² per inhabitant) and extremely high (31.22 m² per inhabitant) in the peri-urban zone, due to the presence there of forests and other natural or semi-natural ecosystems. In addition, green spaces are unequally dispersed within the urban agglomeration, varying from 0.8 m² per inhabitant in the western districts to 30.62 m² per inhabitant in the eastern districts, which reflects the socio-economic differences between the western and eastern parts of the city (Master Plan Agency of Thessaloniki 2006).

To conclude, suburban green space in Thessaloniki was planned with consistency, in order to form a green buffer zone for the city (embedding the "connectivity" feature in this suburban zone at least) and in terms of promoting "multi-functionality" and leisure opportunities. On the other hand, green spaces within the city, even though they tend to correspond to the national standards, are unequally dispersed, whilst their small size can hardly serve the "multi-functionality" feature. In total, despite the planning inefficiencies (due to historical and

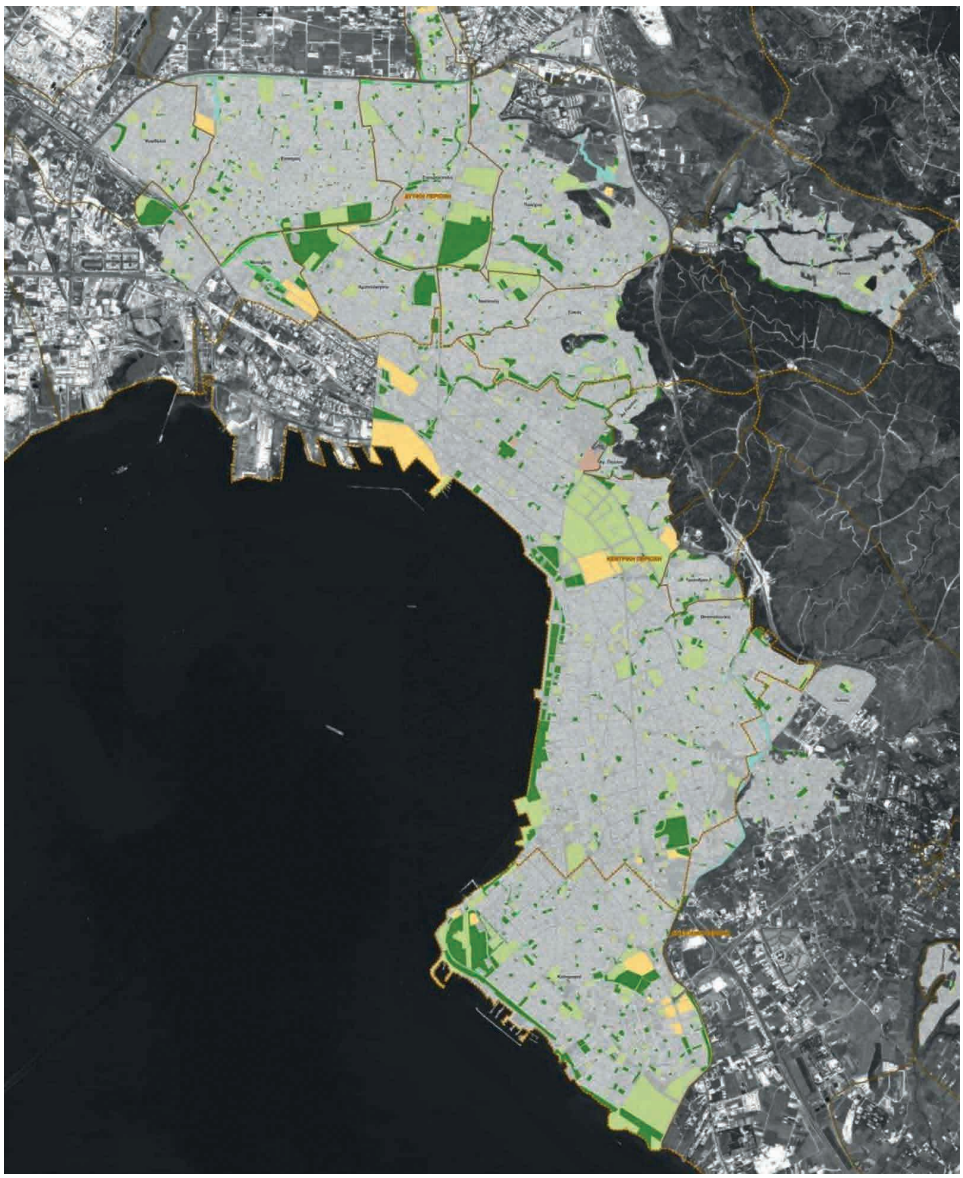

Fig. 2 Green spaces in the urban agglomeration of Thessaloniki.
Source: Master Plan Agency of Thessaloniki (2006).

policy factors), Thessaloniki is notable for a better embedding of the feature "green" compared to Athens, and for providing easier access to green spaces for its citizens (due to their dispersion).

Green planning and the G.I. concept in the master plans for Athens and Thessaloniki

Even though attempts to adopt a Master Plan in Athens and Thessaloniki started in the 1960s, it was only in 1985 (by laws 1515 and 1561) that such Plans were approved for the first time. An important detail of these first Master Plans is that they were both complemented by an Action Plan for the Environment and that in both cases a special Agency was established for the implementation of the Master Plans[3].

Taking fully into consideration the peculiarities of the period in which they were launched and the special features of the two metropolises, the Master Plans focused on smog and air pollution in the case of Athens, and marine pollution in the Thermaikos Gulf in the case of Thessaloniki. Beyond this differentiation, overall philosophy in both Master Plans remained the same regarding the environmental policy and planning, giving priority to: the ecological reconstruction of urban areas, a reduction in air and soil pollution, the protection of the peri-urban agricultural land and the natural ecosystems (forests, mountains, wetlands etc.). As these first Master Plans were enacted in the 1980s (i.e. at a time well before the first use of the term G.I.) when the philosophy of the environmental policy was simple and focused on tackling the urgent and growing ecological problems, such as air, soil and water pollution, which both metropolitan areas were facing. The feature 'green' was the only element

3 In 2014, both Master Plan Agencies were abolished (and absorbed by the Hellenic Ministry for the Environment).

of the GI concept that was given importance mainly in terms of its protection and enhancement. Despite the fact that 'Green Infrastructure' as a term was not used in the first Master Plans, subconsciously, it was implied as an ultimate environmental vision for urban development through the achievement of an upgraded environmental and ecological network for natural or artificial, urban and suburban, ecosystems.

In the 2000s, i.e. approximately 15 years after the enactment of both Master Plans, efforts were made to revise them. This time, environmental planning and "green" were prioritized even more. In view of the revision, both Agencies assigned special projects entitled 'Strategic and Operational Plan for the Upgrade of Green Spaces', one for Athens and a second for Thessaloniki. Although these studies were never completed, they are considered to have provided insights for incorporating the Green Infrastructure concept, since the upgrade in the natural environment, provision of leisure opportunities, along with the physical networking of green spaces, have constituted core-planning directions.

In 2014, both revised Master Plans were introduced to the Hellenic Parliament for their enactment. However, only the one for Athens was approved (by L.4277/2014). Despite this fact, the new versions of the Master Plans had a common philosophy and guidelines for the urban environment and green spaces, focusing on the following goals:

- qualitative and quantitative upgrade of green spaces;
- development of a continuous network of urban green spaces, including Protected Areas and natural ecosystems located in the suburban and peri-urban areas;
- inclusion of open spaces and areas of cultural and historical importance (archaeological sites, monuments, etc.) in this green network;
- protection and wise management of the urban landscape and natural landscapes;
- wise management and planning for the protection of water resources and water surfaces.

To conclude, the recently reformed metropolitan Master Plans encompass in a more advanced way, the concept of Green Infrastructure, despite the fact that the term is not clearly stated. In fact, the Master Plan for Thessaloniki uses the term only once, whereas the Master Plan for Athens paraphrases it as "green grid". Although this tactic seems superficially to be a divergence from the relevant European strategy, actually, the underlying policy conforms to the goals set by the Green Infrastructure policy. Prevailing features in both Master Plans are once again "green" and "connectivity", whilst features of "mul-

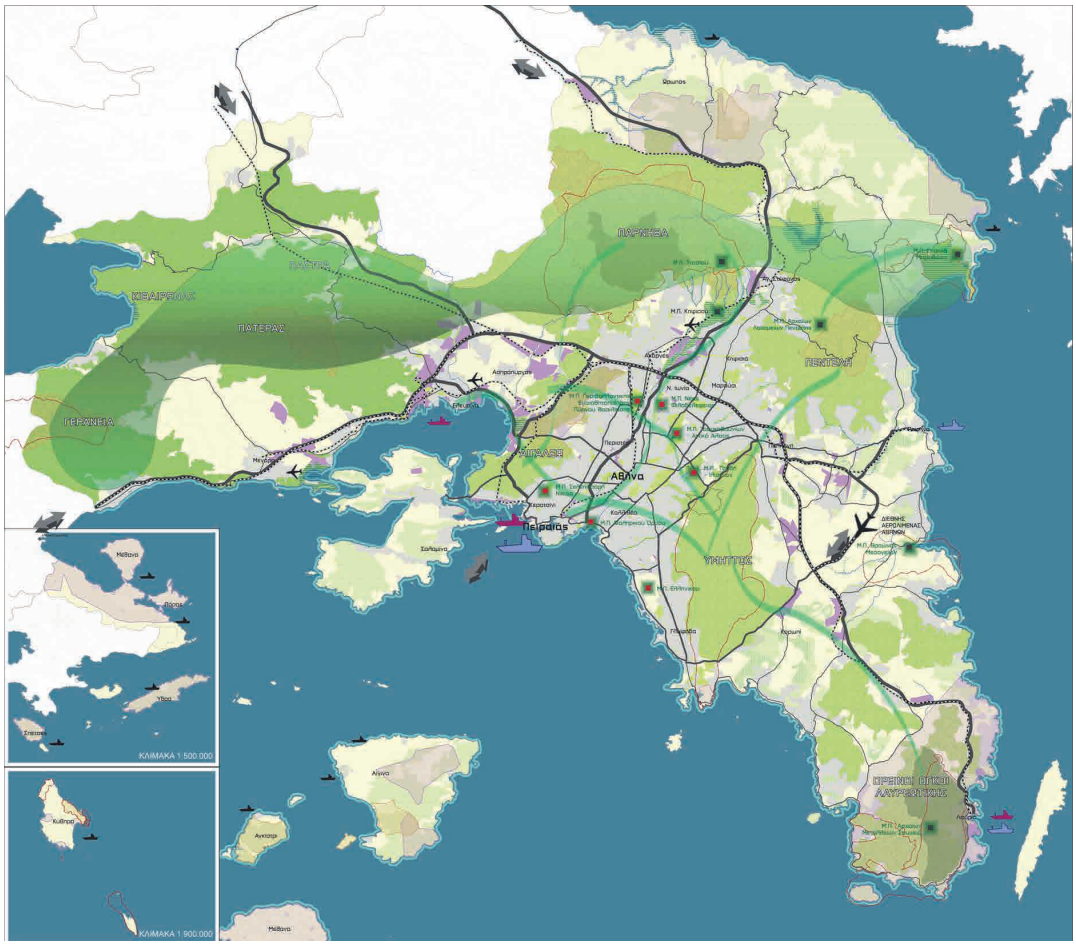

Fig. 3 The vision for a green "grid" in the Athens metropolitan area.
Source: Official Gazette 156/A/2014 (New Master Plan of Athens).

tifunctionality" and "accessibility" are indirectly supported. Indeed, the primary objective of both Master Plans is the development of a continuous network of green spaces of every type and scale, including Protected Areas and natural ecosystems, located either in the urban or in the suburban and peri-urban areas that have multiple functions, dictated by detailed spatial plans. At the same time, important difference from the past (i.e. the Master Plans of the 1980s) is that the blue (aquatic) element has prevailed, given the coastal location of both metropolises.

Evaluation and Discussion

Green Infrastructure is both a planning concept and a tool, aiming to strengthen social and economic revitalization (Thomas and Littlewood 2010) and to enhance the ecological profile of an area (Sandström 2002). Green Infrastructure may address a plethora of goals of economic and social policy, i.e. beyond strict environmental enhancement (Mell 2008). Although some scholars argue that the role of Green Infrastructure in planning is to deliver sustainability "by presenting a new way to address the old problem of reconciling environmental protection with growth" (Owens and Cowell 2011), planning of Green Infrastructure has become a high priority in contemporary planning endeavours.

In Greece, which is a country with a relatively short tradition in environmental planning and management of green spaces, the concept of Green Infrastructure is present in the current planning efforts. This is a fact in the cases of Athens and Thessaloniki and is evaluated in the present paper, both in terms of their environmental planning philosophy and their green spaces. The analysis was mainly based on fragmented data (since there are no studies that provide a full analysis of the urban green spaces in metropolitan areas of Greece), Despite this fact, important conclusions were reached regarding the potentiality and ability of green spaces in both metropolitan areas, to set the grounds for the development of Green Infrastructure in the future. These conclusions are presented below.

"Green"

In Greece, development of green spaces for ecological purposes prevailed after the 1960s. Since then, urban green space has become a priority and a core type of land use in all Greek cities and metropolises. According to the existing data (presented in the analysis), there is a great variety of different sized green spaces in Athens and Thessaloniki. However, green space coverage in both cases lags behind the national standard (i.e. 8 m^2 of green per inhabitant). This lack is estimated by both case studies to be much higher in the case of Athens and much higher in the central districts and the deprived areas. Regarding sub-urban green, although it can compensate for this lack within the cities, it is constantly under threat of fire and of uncontrolled urban development. And despite the fact that both metropolitan areas are located in the coastal zone, the aquatic ("blue") element has played an important role mostly in policy documents (i.e. the Master Plans) and rarely in practice.

The ongoing economic recession in Greece has a contradictory role in the quantitative upgrade of green spaces. On the one hand, it halts the creation of new green spaces, since municipalities do not have the funds to create new urban green spaces according to the enacted spatial plans. On the other hand, the economic recession puts a hold on building activity and uncontrolled urban sprawl, safeguarding the (remaining) suburban green areas and open spaces within the urban core.

"Connectivity"

"Connectivity" has long been identified as a planning goal of environmental and green planning in both metropolitan areas of Greece. However, networking of green spaces became feasible only in the peri-urban zone of both metropolises. Regarding green space within the urban agglomerations, certain planning externalities in both metropolitan areas failed to meet the standard of green space and this undermined most of the efforts to set the grounds for the creation of linkages (and new hubs) between urban green and the peripheral natural ecosystem.

"Multi-functionality"

"Multi-functionality" is a usual goal in most green and environmental planning projects, at all scales. In fact, according to the existing national planning legislation (Official Gazette 285D/2004), green spaces, a compulsory type of land use within the cities, are conceptualized as a system of open spaces of various sizes. They may be covered, fully or partially, by vegetation and are designed to serve different functions such as recreation and leisure, sports, social gatherings, playground for children etc.

In the cases of Athens and Thessaloniki, "multi-functionality" was achieved mainly in the sub-urban green spaces, due to their size. Multi-functionality also characterizes green parks of metropolitan importance in Athens and it is less apparent in the case of green spaces within the city of Thessaloniki.

"Accessibility"

"Accessibility" is another feature that, although rarely expressed in writing, has long been a key planning goal in both metropolitan areas, although not always referring to access by disabled citizens. It was usually interwoven in efforts to achieve dispersion of green spaces ("hubs") and so facilitate the access of all citizens to the green hubs and links, addressing the goals of social cohesion and territorial justice. Dispersion of green spaces in both metropolitan areas varies considerably. Usually, in the historic centers and the deprived areas, the access is quite limited due to the lack of green surface areas. On the other hand,

access to sub-urban green space and metropolitan parks could be better designed to the benefit all citizens.

Given the above evaluation, it is concluded that although the existing green spaces in Athens and Thessaloniki face certain challenges, they can play an important role in the development of Green Infrastructure, on condition that: (i) the proposed (by Urban Plans) new green spaces will be realized (taking into account the national standard of 8 m² per capita), (ii) other G.I. elements (i.e. hubs and links) will be considered, especially the "blue/aquatic" ones (given the coastal character of both metropolises), (iii) more effort will be put into green planning to embed extra functions, (iv) the peri-urban green areas (and the Protected Areas) will be better surveyed and protected against urban sprawl and (v) accessibility will also focus on the facilitation of access for both the non-privileged and disabled citizens, by developing the necessary urban and transport infrastructure, such as pedestrian zones or public transport that will allow all groups of people to have access to these areas.

However, developing G.I. in Athens and Thessaloniki is not only a matter of planning. Natural disasters constitute a constant threat and can cause important alterations in the peri-urban green pace of both metropolitan areas, whilst the current fiscal recession puts an extra burden on implementing all kinds of Plans (spatial, environmental, etc.). Especially in the cases of Athens and Thessaloniki, the conversion of valuable and extended open spaces into built-up areas has become an option (and a threat), which is always under discussion, since using land for construction can provide the state valuable and much-needed revenue.

To conclude, it is of utmost importance that Greek cities and metropolitan areas take advantage of their green spaces in order to "build" a Green Infrastructure, both at the urban and landscape scales. This is especially important for the metropolises of Athens and Thessaloniki, since their size has long contributed to the fragmentation of nature and the loss of biodiversity, resulting in more socio-economic losses.

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