

SPATIAL PLANNING FOR URBAN RESILIENCE. ASSESSING CURRENT PROSPECTS THROUGH A MULTILEVEL APPROACH AND A USE CASE IN NORTHERN GREECE

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Abstract

This paper presents a part of ongoing research into the resilience potential of the western coastal front of Thessaloniki, a medium sized city in northern Greece. It aims to assess whether and to what extent the western coastal front of Thessaloniki, Greece, currently a partially developed area, features elements of resilience and what opportunities can be harnessed to this end. We set out by describing the concept of ‘urban resilience’ drawing upon recently published literature. As primary principles of resilience-driven development, we identify (i) the existence of resilience-focused spatial planning attributes (redundancy, modularity, buffering, connectivity, existence of legally binding land-use or zoning plans) (ii) the presence of a highly adaptive urban spatial management mix, (iii) reflectiveness and the ability to learn from past experience and resilience challenges and (iv) civic engagement, largely facilitated by means of smart city applications. We then shift our focus to the characteristics of the study area. In order to investigate the extent to which the identified from the literature factors affecting urban resilience apply in this area, a profiling of the study area is made, followed by an in-depth analysis of whether and how the identified principles of resilience-driven development are realized through the current urban, regional, transportation and environmental planning and management frameworks applicable to the area. We close with highlighting specific aspects of resilience that call for urgent attention and by making comments and recommendations regarding policy integration needs.

Keywords: Urban, Regional, Transport, Environment, Planning, Management

JEL classification: R00, R1, R4, R5, R11, R14, R19, R40, R49, R52, R58

1. Introduction

In recent years, urban, regional, transportation and environmental planning, design and management professionals and policy makers have been realising increasingly that ad hoc planning and management are counter-conducive to safety in urban environments. In reality, no risk can be completely avoided only by means of mitigation. In this context, the conception of ‘resilience’ seeks to promote the capability of urban systems to adapt and innovate on an ongoing basis, enabling them to withstand shocks and stresses. Altogether, planning for spatial resilience introduces a more sustainable and flexible development paradigm (Lu & Stead, 2013).

Unfortunately, the challenges associated with urban resilience render Greece and Greek cities ideal study cases about how urban resilience can be jeopardised in the face of shocks and stresses. Greece underwent major structural changes in recent decades due to extensive de-industrialization. The Greek debt and immigrant crises of 2009 and 2015 respectively posed transformative challenges on the previously existing urban sociotechnical systems of Greek cities. The above were complimented by other, less severe stressors and disasters, appearing mostly as a result of poor infrastructure maintenance and lack of urban renewal initiatives due to domestic financing deficits.

Accounting for this situation, this paper presents part of ongoing research into the resilience potential of the western coastal front of Thessaloniki, a medium sized city in northern Greece. In doing so, this paper aims to introduce a multilevel approach to assessing the prospects for urban resilience, and further assess whether and to what extent the existing spatial planning provisions for the western coastal front of Thessaloniki, Greece, conform with the principles of resilience-focused development. This paper focuses specifically on the theme of urban resilience as a holistic approach to development. We acknowledge the intricate dimensions of resilience that span economy, society and the environment; however, in this paper we address these dimensions through the integrated lens of urban resilience.

The structure of this paper is as follows: Section 2 presents the major literature regarding spatial planning factors affecting resilience in urban areas. Section 3 introduces an urban resilience assessment framework and presents the research methodology used in this piece of research. Section 4 presents the results of the conducted research. Section 5 features the conclusions and recommendations rising from the performed analysis.

2. A literature review of the spatial planning and management factors affecting resilience in urban areas

2.1. The notion of resilience in urban areas

As a notion, resilience has been used for decades in the fields of physics and psychology. Broadly speaking, it is used to describe the ability of a system to revert to a condition of equilibrium after a shock or stress. It was first introduced in ecology science by Holling (1973) to describe the ability of ecological systems to absorb changes and re-structure toward a new equilibrium state.

Soon after that, the idea of resilience penetrated policy making for development and started appearing in national and local development policy agendas (Evans, 2011; Martin-Breen & Anderies, 2011). In recent years, strategic frameworks of urban resilience have been created by major organisations, such as the Organisation for Economic Co-operation and Development (OECD, 2016), the European Commission (EC) (Lechner, 2015) and the Rockefeller Foundation in association with ARUP (The Rockefeller Foundation and ARUP, 2015). Today, resilience propositions and frameworks can be found in a very broad variety of development related areas, spanning economy, environment, and society.

Nevertheless, resilience is considered to be a highly contested and ambiguous term. The bibliometric analysis by Meerow et al. (2016) found 25 different definitions of 'urban resilience'. Other research by Desouza and Flanery (2013) and Beilin, Reichelt, & Sysak (2013) also notices difficulties of definition, as well as challenges in the setting of strategic objectives (e.g. *'to what must cities be resilient?'*). Moreover, there is a tendency to interpret urban resilience according to the expertise of the involved professionals (Stumpp, 2013).

A commonly used definition of urban resilience is the one of OECD (2016), popular due to its completeness and comprehensibility: *'Resilient cities are those able to absorb, adapt, transform and prepare for past and future shocks and stresses in order to ensure sustainable development, well-being and inclusive growth'*. The emphasis of this approach is on the different capabilities of resilient cities (prepare, absorb, adapt, transform), the different types of challenges to urban resilience (shocks, chronic stresses) and the relevance of a range of factors (economic, social, environmental, institutional) that affect urban resilience positively or negatively. Threats facing urban resilience can either refer to sudden shocks, or stressful conditions which accumulate over time, posing chronic pressures on urban systems (Lechner, 2015; Martin-Breen & Anderies, 2011).

The meaning of resilience may differ across cities, just like cities are unique themselves. Despite the existence of several methodologies, enhancement of resilience in a city framework should be regarded as an ongoing process that calls for calibration depending on the specific internal and external features of each city. Hence, urban resilience strategies should focus on continuously optimizing the combination and utilisation of measures and urban resources under a systems' approach (Desouza & Flanery, 2013; Martin-Breen & Anderies, 2011).

2.2. Resilience oriented spatial planning and design

The resilience literature puts forward a series of spatial planning and design attributes that are conducive to urban resilience. These include redundancy, modularity, buffering, connectivity and the existence of legally binding land-use or zoning plans. Specifically, redundancy refers to the availability of reserve resources in times of crisis. It enhances the capacity of urban systems to accommodate increased demand for a specific service in periods of pressure or crisis (Ahern, 2010, 2011; Desouza and Flanery, 2013; Eraydin and Taşan-Kok, 2013; Godschalk, 2004; OECD, 2016; Wardekker, de Jong, Knoop, & van der Sluijs, 2010; Wilkinson, 2011). It is a very important resilience attribute, in the sense that it enhances the ability of urban systems to resist shocks and stresses and facilitates rapid recovery (The Rockefeller Foundation and ARUP, 2015). Modularity is a planning and design related attribute of resilience in urban systems which enhances compartmentalisation and autonomisation and compliments redundancy (Ahern, 2010, 2011; Desouza & Flanery, 2013; Eraydin & Taşan-Kok, 2013; Godschalk, 2004; Lechner, 2015; Wardekker et al., 2010; Wilkinson, 2011). Through modularity, risks are spread across different geographical areas, urban systems and time zones, which can be better controlled through distributed control and decision making points (Ahern, 2011; Martin-Breen & Anderies, 2011). Complimentary to the previous, the next identified planning and management related attribute of resilience in urban systems is buffering (Desouza & Flanery, 2013; Fleischhauer, 2008; Wardekker et al., 2010; Wilkinson, 2011). The practice of buffering refers to the provisioning of land use-free zones or zones where a very limited range of land uses is allowed. These areas are intended to act as 'buffers' to a potential spreading of a stress or crisis, preventing transmission to adjacent urbanised areas, and/or provide a 'quick way out' or gathering points as a response to crisis situations (Fleischhauer, 2008). Modularity and buffering do not necessarily point to loss of connectivity, however. In fact, connectivity is one more of the planning related attributes of resilience in urban systems identified through this exercise (Ahern, 2010, 2011; Cumming, 2011; Desouza & Flanery, 2013; Eraydin and Taşan-Kok, 2013; Godschalk, 2004; Wilkinson, 2011). It is important because it allows for help and coordination networks to be developed and become active and it creates new opportunities for self-organization (Desouza & Flanery, 2013; Wilkinson, 2011). Moreover, connectivity allows for the development of linkages between seemingly different layers of urban systems – for example citizen services and urban transportation systems. Finally, legally binding land-use or zoning plans are one more planning tool that can be used in spatial planning for resilience (Fleischhauer, 2008). Application examples can be found in inhabited areas in high risk of becoming affected by industrial accidents and settlements in proximity to highly protected natural ecosystems.

2.3. Highly adaptive urban spatial management mix

In recent years, planners increasingly came to understand that ad hoc planning and management cannot fully guarantee urban safety. Ability to adapt is possibly the most important precondition for urban resilience in this regard: a resilient system should be able to adapt dynamically in the face of change, even if this means that it will function in a different way (Lechner, 2015). Urban systems become more resilient when they are allowed to restructure, develop and innovate, while they are more exposed to stressors when they are static, inflexible and conservative (Fernandes & Chamusca, 2014). This adaptation can be thought of as cyclic, taking place across so-called 'adaptive cycles', referring to a continuous transition between states of growth and exploitation, conservation, collapse or release, and renewal and reorganisation (Carpenter, Walker, Anderies, & Abel, 2001; Holling, 2001). Recoursefulness, in the sense of being able to use the resources available at any time to

restore service functionality, enforces the adaptation capability of urban systems (OECD, 2016; The Rockefeller Foundation and ARUP, 2015). The same is valid for the capability to innovate, which allows new ways of thinking to emerge (Walker & Salt, 2012). The significance of adaptive planning for resilience can be better understood if we consider the fact that urban identity and urban landscapes themselves are not static. Instead, they develop at different paces, on different scales, and in different directions (Beilin et al., 2013; Collier et al., 2013; Evans, 2011; Kafkalas, Vitopoulou, Gemenetzi, Giannakou, & Tasopoulou, 2015; Martin-Breen & Anderies, 2011; OECD, 2016). Altogether, the presence of a highly adaptive urban spatial management mix implies that there is a need for integration of the multi-level (urban, regional) and multi-sectoral (transport, environment) planning aspects for resilience.

2.4. Reflectiveness and ability to learn from past experience and resilience challenges

Reflectiveness, in the sense of being able to learn from past experience and adapt standards and behaviour accordingly is one of the major characteristics of sustainability (Ahern, 2010, 2011; Desouza & Flanery, 2013; Eraydin & Taşan-Kok, 2013; Evans, 2011; Godschalk, 2004; OECD, 2016; The Rockefeller Foundation and ARUP, 2015; Wilkinson, 2011). In planning for resilience, planners and planning authorities should be able to discern the processes and events that pose risks to the social and environmental metabolism of the city (Ahern, 2011). Many of the intractable challenges of resilience in urban environments are rooted in the ways that cities have developed in the past, in ageing infrastructure and geopolitical conditions (Collier et al., 2013). It is thus essential to make proper use of experiential knowledge when strategising for urban resilience (Folke, 2006; Wilkinson, 2011) and use strategic foresight to increase the level of preparedness in the face of unexpected events (Desouza & Flanery, 2013; Wardekker et al., 2010; Wilkinson, 2011).

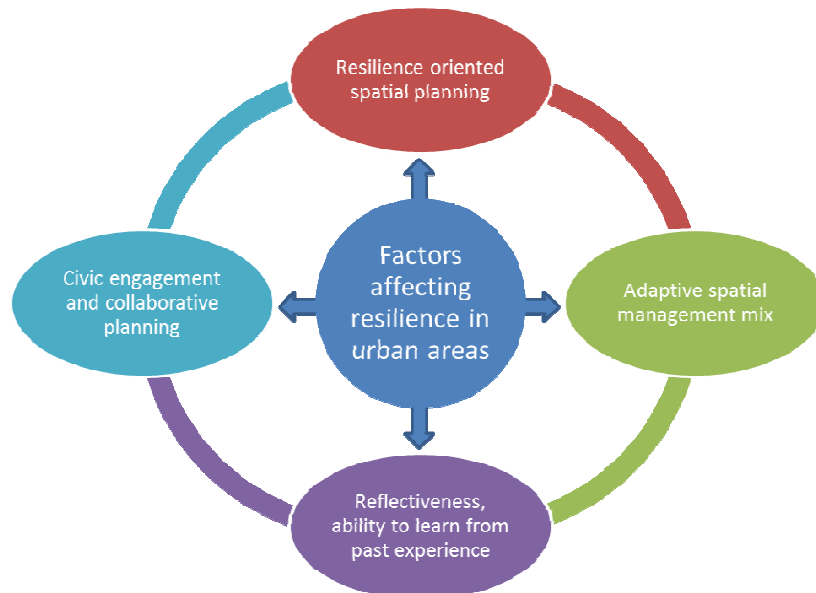
2.5. Civic engagement and collaborative planning

Urban resilience requires the capability of a city and its inhabitants to learn continuously and adapt to changing circumstances (Collier et al., 2013; Newman et al., 2009). Emphasis is also given to the enhancement of broad scale collaboration and knowledge exchange toward enhancing resilience in urban systems (Kafkalas et al., 2015; Martin-Breen & Anderies, 2011; OECD, 2016; The Rockefeller Foundation and ARUP, 2015; United Nations Office for Disaster Risk Reduction, 2012, 2015). In recent years it has been realised increasingly that economic resilience is closely tied to social resilience (Fischer, 2015; OECD, 2016; Stigson, 2015; The Rockefeller Foundation and ARUP, 2015; United Nations Office for Disaster Risk Reduction, 2012) and that public participation advances the creation of alliances between stakeholders, an element that is crucial for urban resilience (Desouza & Flanery, 2013; Godschalk, 2004; United Nations Office for Disaster Risk Reduction, 2012; 2015). Moreover, knowledge coming from non-experts, citizens and their communities carries high added value in the urban management mix (Angelidou & Psaltoglou, 2017; Collier et al., 2013) –citizens and their communities can act as tacit and localised knowledge transmitters and co-developers of identity, culture and conscience, while maintaining increased levels of flexibility and adaptivity (Beilin et al., 2013; Cumming, 2011; Giovannini, 2015; Lechner, 2015). An inclusive approach toward urban resilience enforces frequent and tight information feedback loops, allowing the urban system to normalise disturbances and become more stable (Walker & Salt, 2012; Wardekker et al., 2010). It also drives the emergence of innovative and more participatory business models in funding for resilience (The World Bank, 2015; United Nations Office for Disaster Risk Reduction, 2015). Social inclusion and participation has inherent implications for spatial planning, with positive or negative effects on accessibility to public infrastructure, ghettoization, and decline in urban areas. The role of advanced technology is especially important with regards to urban flexibility, as smart city solutions and applications can monitor urban functions on a real time basis (Angelidou, 2017; 2015; 2014). Data can then be used in urban systems to adjust their behaviour accordingly (The Rockefeller Foundation and ARUP, 2015).

2.6. An integrated framework for urban and environmental planning and design for resilience

From the above analysis we infer that in the context of resilience, urban areas should be seen as integrated socio-ecological systems (Evans, 2011). An integrated spatial planning for resilience framework accounts for a series of principles as featured in Figure 1.

Figure 1: Dimensions of an integrated resilience spatial planning in urban areas.



Source: authors' elaboration

This framework accounts for the identified factors affecting urban resilience, as they emerged from the analysed literature. More specifically, as the four major factors affecting resilience in urban areas, we identify (i) resilience oriented spatial planning, (ii) a highly adaptive spatial management mix, (iii) reflectiveness and the ability to learn from past experience and resilience challenges and finally (iv) civic engagement and collaborative planning. In the following section we explain how this analysis of the literature was used to assess the current prospects for urban resilience through a multilevel approach in a use case in northern Greece.

3. Research methodology

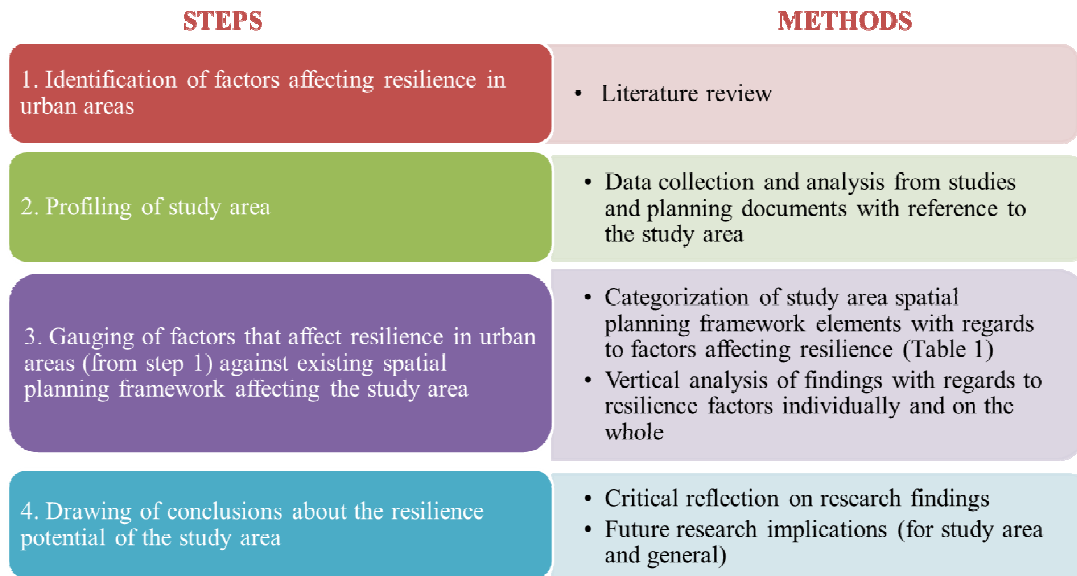
As mentioned, this paper presents an effort to perform a holistic assessment of the resilience potential of the western coastal front of Thessaloniki, Greece. The city of Thessaloniki spans more than two thousand years of history since its official inauguration, while only during the past 100 years it has undergone an incredibly large number of events that threatened its resilience, including a citywide fire in 1917, world and civil wars, international migration and abrupt population exchanges in the first half of the 20th century, a seven year dictatorship (1967-1974), extensive and largely uncontrolled deindustrialisation and urbanisation during the second half of the 20th century. The city was also acutely affected by the European debt crisis beginning in 2009. Today Thessaloniki suffers from limited economic and cultural dynamism, decay of the local entrepreneurial ecosystem, and loss of a large fraction of its intellectual capital (Labrianidis, 2011). Although this situation is in full progress in Thessaloniki and most Greek cities, many of the above mentioned resilience threats of the past were tackled successfully. Compared to other Greek cities, Thessaloniki presents an ideal case study for resilience assessment at many levels. The city has for decades been compelled to operate within a highly centralised and complex governance system. In addition, the potential to become an economic hub in the Balkan area is far from being realised (Labrianidis, 2011; Williams, Vorley, & Ketikidis, 2013).

The specific area of the western coastal front of Thessaloniki, currently only partially developed, was selected for a number of reasons: (i) it is part of the so-called coastal front of the Broader Thessaloniki Area, with a coastal length of approximately 50km, that for decades

has been attracting discussion regarding its high fragmentation and underexploited potential in social and economic terms and (ii) the western part of the Broader Thessaloniki Area hosts major transport and energy infrastructures of supra-local importance and is an area well known for its conflicting land uses.

Our approach to the assessment of the resilience of the western coastal front of Thessaloniki is methodologically featured in Figure 2:

Figure 2: Research methodology followed in this research (source: authors' elaboration)



Source: authors' elaboration

More particularly, Step 1. 'Identification of factors affecting resilience in urban areas' was performed through the literature review of section 2 of this paper. In this step we identified four factors affecting urban resilience, namely:

- Resilience oriented spatial planning
- Adaptive urban spatial management mix
- Reflectiveness, ability to learn from past experience
- Civic engagement and collaborative planning

In Step 2, 'Profiling of study area', we collected and analysed twenty spatial planning and management documents with reference to the study area, covering a period from 1975 up to today and focusing on different administrative levels (international, national, regional, municipal) and topics (urban planning, regional planning, transport planning, environmental management, resilience management). They are presented in the following Table 1 with their spatial level of reference (Municipal Unit, Municipal, Metropolitan, Prefectural, Regional, National, European, Global):

Table 1. Spatial planning and management documents examined and spatial level of reference

Spatial planning and management documents	Spatial level
General Urban Plan of the Municipal Unit of Echedoros, Municipality of Delta (2011)	Municipal unit
General Urban Plan of the Municipal Unit of Chalastra, Municipality of Delta (2010)	Municipal unit
General Urban Plan of the Municipal Unit of Menemeni, Municipality of Ampelokipoi-Menemeni (2016)	Municipal unit
Municipality of Delta, Operational Programme 2014-2019, Phase 1: Strategic Planning (Municipality of Delta, 2015)	Municipal
Municipality of Delta, Operational Programme 2012-2014, Phase 1: Strategic Planning (Municipality of Delta, 2012)	Municipal

Spatial planning and management documents	Spatial level
Municipality of Ampelokipoi-Menemeni, Operational Programme 2014-2019, Phase 1: Strategic Planning (Municipality of Ampelokipoi-Menemeni, 2015)	Municipal
Municipality of Ampelokipoi-Menemeni, Operational Programme 2011-2014, Phase 1: Strategic Planning (Municipality of Ampelokipoi-Menemeni, 2015)	Municipal
Resilient Thessaloniki Strategy (Municipality of Thessaloniki, 2017)	Metropolitan
Action Plan for the Western Coastal Front of Thessaloniki (Region of Central Macedonia, 2016)	Metropolitan
Study for the pollution of Thermaikos Gulf and Immediate Mitigation Proposals (in Greek) (Fytianos, 2008)	Metropolitan
Unified Transport and Infrastructure Master Plan for the Broader Thessaloniki Region until 2020 (Greek Ministry of Transport, 2010)	Metropolitan
Sustainable Urban Mobility Plan for the Metropolitan Region of Thessaloniki (Thessaloniki's Integrated Transport Authority, 2013)	Metropolitan
New regulatory plan of the Prefecture of Thessaloniki -under development- (Greek Ministry of Environment and Energy, 2011)	Prefectural
Regional Framework for Spatial Planning and Sustainable Development of Central Macedonia (Greek Ministry of Environment and Energy, 2004a; 2013)	Regional
Regional Operational Program of Central Macedonia (Greek Ministry of Economy and Development, 2014a)	Regional
Regional Innovation Strategy for Smart Specialisation of Central Macedonia (Greek ministry of Economy and Development, 2014b)	Regional
Seismic Risks Map for Greece (Greek Ministry of Environment and Energy, 2004b)	National
Natura 2000 network of protected areas (European Commission, 2006)	European
EU Floods Directive (2007/60/EC) (European Commission, 2007)	European
Ramsar Convention (Ramsar Convention Secretariat, 1971)	Global

Source: authors' elaboration

Some of the above studies were accessed online, while others were acquired through their owning authorities. We also scanned thoroughly the websites of the Municipality of Delta (2017) and Ampelokipoi-Menemeni (2017) for any relevant information.

In Step 3, 'Gauging of factors that affect resilience in urban areas against existing spatial planning framework affecting the study area', we arranged the study area spatial planning framework elements identified in Step 2 regarding the factors affecting urban resilience identified in Step 1. A table was created (Appendix, Table 3), gauging the above studies against the identified major resilience principles, using the model as seen in Table 2:

Table 2. Model table created to support the analysis of the research findings

Dimensions affecting urban resilience (from literature)			
Resilience oriented spatial planning	Adaptive spatial management mix	Reflectiveness, ability to learn from past experience	Civic engagement and collaborative planning
Study/Regulation 1
Study/Regulation 2
.....

Source: authors' elaboration

Finally, in Step 4, 'Drawing of conclusions about the resilience potential of the study area', we performed a critical reflection on the findings of the research performed and

considered future research implications, both for the study area and in general. The outcomes of this step are featured in section 5 of this paper.

4. Findings

4.1. Profile

The study area is located in Greece and more specifically the western part of the city of Thessaloniki. It refers to the western coastal front of Thessaloniki, starting from the end of the city's commercial and touristic harbour at the edge of Thessaloniki's Central Business District (CBD) and ends at river Loudia's delta, west and outside the city core, as seen in Figure 3. One part of the study area belongs to the Municipality of Delta (about 46,000 residents based on the 2011 Census of the Greek Statistical Authority) and another smaller part belongs to the municipality of Ampelokipoi-Menemeni (about 90,000 residents based on the 2011 Census of the Greek Statistical Authority). Both municipalities are considered peri-urban to the core city.

Figure 3: The boundaries of study area



Source: authors' elaboration from Google Maps

The study area hosts multiple and highly conflicting land uses. Specifically, it hosts dense and sprawled urban agglomerations; it is located close to important, supra-local urban infrastructures for education, mobility and energy production, while it also includes major protected wetlands and natural environments. In recent years, this area has attracted major interest from policy makers, spatial planners and other urban stakeholders due to its underdeveloped potential and high stakes resulting from land use conflicts, which could cause potentially detrimental effects to the entire Thessaloniki region (Region of Central Macedonia, 2016).

In terms of inhabited environment, the study area includes the settlement of Kalochori, belonging to the Municipality of Delta, counting 4.672 permanent residents (based on the 2011 Census of the Greek Statistical Authority). Kalochori was created as a refugee settlement in 1922, when refugees arrived here from western and northern Thrace. The urban plan of Kalochori, as seen in Figure 4, is characterized by uniformity based on a modular, rectangular grid – the so-called 'Hippodamian plan'. There is one main entrance and main exit from the settlement, but evidently entrance and exit can take place through many, uncontrolled secondary roads. The settlement is crossed by two major roads with an increased concentration of commercial uses. The most striking observation regarding the settlement of Kalochori is the extended sprawl of industrial and related commercial uses outside but very close to the settlement boundaries. The settlement is also situated close to the Industrial Area of Kalochori.

Figure 4: The settlement of Kalochori in the study area



Source: authors' elaboration from Google Maps

The broader area is host to other large industrial facilities and activities of the secondary sector, as well. The largest facilities which are located in the study area are the facilities of Hellenic Petroleum S. A. in Kalochori, the TITAN cement industry jetty, the muscatures in Axios's and Loudias's deltas, the Wastewater Treatment Plant of Thessaloniki in Sindos area, the livestock units and the tannery of Gallikos river.

In addition, the site includes very significant supra local infrastructure networks. It is bounded by PATHE (Patras – Athina – Thessaloniki – Euzoni motorway), and contains a complex local network of secondary road systems. Moreover, it is crossed by the city's supra local commercial and passenger rail network. The area includes a water supply network and a separate drainage network. Finally, the energy network in the study area is significant. It includes low and medium pressure gas pipelines, as well as a crude oil pipeline across the north-eastern boundaries of the study area (Municipality of Delta, Municipality of Ampelokipoi-Menemeni).

In terms of natural environment, the area includes a large number of rivers (Loudias, Gallikos, Axios and Dendropotamos) which have their delta in the study area, wetlands, areas belonging to the NATURA - Ramsar 2000 program, as well as a rich marine environment (Kalochori's lagoon, sand dunes, salt mines, Thermaikos sea).

4.2. Resilience oriented spatial planning

With regards to the first characteristic of spatial planning for resilience, 'resilience oriented spatial planning', the analysis (Appendix, Table 3), shows that spatial planning on the municipal level, referring to urban planning in the Greek spatial planning system, incorporates some significant elements of resilience -although not all of them. Specifically, modularity is achieved through the designation of urban unities and neighbourhoods, as foreseen by the national urban planning framework. Strict land use restrictions are imposed on high risk areas, and buffering zones free of use between urbanized settlements and industrial areas are planned. Emphasis is also given to increasing supra-local connectivity by means of transport infrastructure. No special provision to secure redundancy of urban and rural resources is made. The economic and operational management programmes of municipalities' concerned lack a focus on enforcing spatial planning for resilience other than promoting a certain degree of modularity through economic diversification across commercial areas and highlighting local characteristics as comparative advantage.

On the metropolitan level, the Resilient Thessaloniki Strategy (Municipality of Thessaloniki, 2017) identifies key issues related to spatial structure as critical for resilience in the area, including: (i) the role of public and open spaces as places that foster interaction, collaboration and inclusivity; (ii) the importance of neighbourhood based economic diversification; (iii) the need to develop a robust polycentric governance system; and (iv) the need to enhance connectivity by means of sustainable, transit oriented development and smart urban logistics across the metropolitan area.

Advancing to the regional level, the distance between resilience and spatial planning appears to increase. Directions on this level become strategic and planned and less associated to space. Polycentric governance and the designation of environmentally protected zones and

areas for the organization of productive and entrepreneurial activities are the foremost space management-related attributes. Economic diversification, compact urbanization and connectivity are seen as drivers of cohesion, development and competitiveness. Two noteworthy observations are that policies at this level provision urban regeneration programmes in specific areas and introduce integrated environmental and crisis management frameworks. Nevertheless, the granularity of measures at this level is low and disassociated with space.

Environmental management frameworks appear to focus on the regulation of natural ecosystems and environmentally protected areas rather than address anthropogenic effects on the natural environment. This observation is alarming, considering that environmental problems due to the existence of dense or sprawled productive activities and dense transport infrastructure have been in the forefront of interest of the local citizens and the local press for decades.

On the transportation planning level, connectivity is a major objective of the Unified Transport and Infrastructure Master Plan (Greek Ministry of Transport, 2010), especially regarding the road network. Redundancy and buffering are achieved through internal and external ring roads and connecting roads between them and the national road network. Regarding fixed route transportation systems, a planned light rail line seems to offer poor redundancy. The same goes for organized parking places and multimodal transport stations. Modularity is achieved by splitting the city's transportation masterplan into smaller transportation projects that can function autonomously.

4.3. Adaptive spatial management mix

An alarming observation emerges regarding the adaptation capabilities enhanced through the analysed spatial and environmental plans and regulations with an effect in the area (Appendix, Table 3): almost none of these plans includes provisions for improving the adaptive capabilities of local systems.

Resilient Thessaloniki's Strategy (Municipality of Thessaloniki, 2017) mentions the need to establish monitoring systems for local governance and environmental resilience, as a basis for continuously adapting the city's approach to resilience. No specific indicators and monitoring mechanisms are highlighted. On the other hand, regional and metropolitan transport management is by nature geared towards adaptivity attributes. The Unified Transport and Infrastructure Master Plan for the Broader Thessaloniki Region until 2020 (Greek Ministry of Transport, 2010) seeks, among others, to create a variety of available transportation modes and increased import/export options. The Sustainable Urban Mobility Plan for the Metropolitan Region of Thessaloniki (Thessaloniki's Integrated Transport Authority, 2013) introduces a periodic procedure of stakeholder engagement and recalibration of the approach toward sustainable mobility.

With regards to the existence of an adaptive spatial urban management mix, we discern that adaptivity is mostly present in transport management frameworks which by nature are geared toward multimodality and offer a variety of transportation options. Yet, with regards to transport management there is little room for flexibility and innovation in times of crisis. Spatial and environmental planning frameworks fail to introduce the capability to adapt, innovate and reconfigure in the face of resilience threats. There is also lack of an integrated approach to land, marine and inland waters' environment, despite the fact that the study area is a coastal urban region, additionally hosting protected wetlands and natural environments as well as a number of rivers and their deltas.

4.4. Reflectiveness, ability to learn from past experience

In terms of the third urban resilience-enforcing factor that emerged from the literature, the ability to reflect on and learn from past experience, the results of the analysis are mixed (Appendix, Table 3).

Specifically, experiential knowledge is largely neglected on the municipal planning level. The included municipalities General Urban Plans and Operational Programmes do not account for experiential knowledge.

The only exception is the Operational Programme of the Municipality of Ampelokipoi-Menemeni until 2019 (Municipality of Ampelokipoi-Menemeni, 2015), whereby specific earlier pressures on society, demography and quality of life have been taken into account in the design of the current programme.

The “Resilient Thessaloniki Strategy” (Municipality of Thessaloniki, 2017) acknowledges past resilience challenges that were overcome in the city, as proof for its inherent resilience capability. However, the strategy does not explicitly identify the mechanisms that were activated to overcome those challenges.

On the regional planning level, the plans that were analysed adopt a general approach with regards to reflectiveness and past experience. This approach translates into natural, historical and cultural heritage resources as assets that need to be managed in order to increase economic competitiveness in the area. Nevertheless, the element of identifying past challenges in the region, how they were overcome, and what helpful ‘lessons’ can be deduced for today, is absent.

Environmental management regulations emphasize the need to establish databases and environmental monitoring systems that will allow more informed environmental risk assessment and actions that are more responsive to the challenges and needs of the local physical environment.

On the transportation planning level, the situation appears to contribute to the leveraging past experience. The need to achieve consensus and high degrees of integration is stressed, in contrast to previous practices. Moreover, the Sustainable Urban Mobility Plan for the Metropolitan Region of Thessaloniki (Thessaloniki’s Integrated Transport Authority, 2013) adopts a continuous approach to assessing sustainable urban mobility through the examination of previous experiences and each step taken.

As a general inference, one can argue that reflectiveness and the ability to learn from past experience in the policy and planning framework for the western coastal front area of Thessaloniki are utilized in a fragmented and theoretical way. In addition, they are focused on monitoring current events rather than closely examining past events and their implications for today’s practices.

4.5. Civic engagement and collaborative planning

Advancing to the last urban resilience element identified, referring to urban stakeholder empowerment through equal representation, co-design and collaboration, as well the encouragement the development of help and support networks and the role that digital tools can play, the situation appears to be more promising, although there is lot of room for improvement (Appendix, Table 3).

More specifically, on the municipal planning and management level, collaboration with citizens is either completely ignored or sparsely and vaguely mentioned. Emphasis is rather placed on institutional stakeholders (local social and economic institutions, administrative entities, educational institutions, international networks) as potential collaborators.

The Resilient Thessaloniki Strategy (Municipality of Thessaloniki, 2017) is exemplary in regard to civic engagement and collaborative planning. The strategy envisions Thessaloniki as a place for vibrant multi-stakeholder representation, civic innovation and inclusivity. Co-creation and urban stakeholder engagement, as well as the establishment of collaboration networks among them, are major pillars of the strategy. Open urban data and technology tools are seen as catalytic forces behind the development of robust approaches to sustainability.

On the regional planning level, civic engagement is mostly enacted through national law requirements for public consultation. The approaches analysed target mainly institutional stakeholders, who are expected to participate in the development and implementation of civil protection and security plans and communicate them to their constituencies. Digital growth is envisioned as a major intervention axis, to be realized by increasing open data availability, systems interoperability, smart city applications and services’ availability and finally, by enhancing the digital skills and accessibility of the population. However, civil society is seen as the end node of the information line, primarily seen as the end consumer of policies, rather than a co-creator. Altogether, programmes and actions to promote social inclusion, economic competitiveness and environmental protection appear loosely connected to digital growth.

Across the entire environmental management level, the need to establish robust environmental monitoring systems using digital tools is stressed but there is no provision for civic engagement and broad scale collaboration to mitigate resilience threats.

On the transportation planning level, an 'open to all' approach is provisioned, which is again mainly addressed to institutional stakeholders, rather than citizens.

Altogether, it can be argued that engagement and collaborative planning for urban resilience takes place mainly in consort with institutional stakeholders. Although this observation can be justified on the regional governance level (the basic role of regional authorities is to deliver and customize national policy directions to the lower tiers of government), it is especially surprising and alarming for municipal governance as municipalities represent the foremost level of urban governance on which citizens are expected to engage in public dialogue, communicate local knowledge and organize in mutual help networks and communities. In addition, the opportunities and capabilities rising from 'smart' growth and digital tools are largely underexploited.

5. Conclusions

In this paper, we analysed the resilience potential of the western coastal front of Thessaloniki by identifying the constituting elements of urban resilience and investigating whether and how these elements have been incorporated in the spatial planning framework (urban, regional, transportation, environmental) as it applies to the area. Our findings show that specific aspects of urban resilience-oriented spatial planning, including modularity, land use restrictions, buffering and connectivity, are relatively well incorporated in current provisions. However, redundancy –possibly the most important characteristic- is consistently neglected across all spatial planning scales. The lack of redundancy in all current planning and management frameworks reduces the ability of the area to withstand shocks and stresses and accommodate increased demand in a time of crisis. We also made an alarming observation that almost none of the analysed spatial and environmental plans and regulations that apply to the area enforces the adaptive capabilities of local systems. This weakness deprives local citizens, institutions, and systems, of the ability to innovate, use their resources differently and pursue alternative routes for organization in times of crisis. Moreover, despite the availability of a wealth of past experiences, learning from past resilience challenges is also neglected in the current spatial planning and management framework. This deprives the western coastal front of Thessaloniki of the opportunity to be better prepared and employ relevant solutions to become more resilient. Finally, participatory governance is realized only partially, focusing on institutional stakeholders rather than citizens, and leverages only sparsely the opportunities arising from digital social innovation tools.

Unfortunately, the cycle of non-resilience tends to be magnified in times when resilience is needed the most. In times when resilience is impeded by factors such as lack of funding required for implementing development projects, lack of awareness and reflectiveness and a general state of disorganisation, the need to break out of the non-resilience cycle appears to be the most pressing. The lack of financing for urban development projects is especially problematic, as it hinders the creation of proof of concept, i.e. implemented projects that could influence thinking about urban development and drive citizens and their communities to become agents of change.

Another important observation has to do with the systemic transfer of resilience (or non-resilience) across urban systems: poor environmental management poses threats to public services' resilience, poor transport management generates social resilience threats, and so on. It is impossible to create a resilient system in a place where other, non-resilient systems exist. All the above raise questions about what decisions need to be made and what actions need to be pursued in order to escape the non-resilience cycle. In all cases, it is clear that a systemic approach is required to improve urban resilience and that urban resilience is closely tied to all social, economic and environmental aspects.

A major observation to make is that there are large disparities and a high degree of fragmentation among the different scales of governance and planning frameworks (local, metropolitan, regional, national, international). An integrated approach to resilience is lacking in each scale, let alone across them. Metropolitan governance in Thessaloniki appears to be the most important missing link that would allow the transfer of regionally imposed, strategic

and tactical resilience principles to the local (urban) operational level. Many of the challenges encountered in the area, such as environmental pollution and sprawl of light industrial activities, surpass municipal boundaries and are issues that call for attention from higher level jurisdictions. An integrated management of environmentally sensitive and highly productive areas beyond municipal boundaries, which would be normally imposed on the metropolitan level, is missing. As a result, municipalities are left to struggle in their own capacity with resilience threatening factors.

Moreover, urban, regional, transportation and environmental planning appear to address different aspects of resilience. Specifically, transport management frameworks mainly address resilience from the standpoint of connectivity. Regional development frameworks address resilience as an issue of local economic diversification and organization of economic activities in zones. Urban and municipal plans address resilience through the designation of urban unities and neighbourhoods (modularity), controlling land use in high risk areas and introducing buffering zones. These buffering zones, however, cannot be considered generous by any means. The lack of common understanding and consequently the adoption of a common approach about urban resilience hinders the constitution of a unified, integrated approach that would allow for coordinated mitigation of resilience threats. This would be especially important for the area studied, which combines significant land, marine and inland waters' environments.

A final question is related to the enforcement and the implementation of the framework analysed in this paper. The provision of a spatial planning framework enforcing urban resilience is only the first step to enhance resilience. Next, however, this framework needs to be designed and implemented in order to adopt a complete approach to resilience. Moreover, this approach should allow for room for constant recalibration to reflect recent developments and current opinions. All of the above point to the conclusion that a shift in thinking for spatial planning and the provision of institutional regulations are required in order to enhance the resilience potential of the western coastal front of Thessaloniki.

References

- Ahern, J. (2010). Planning and design for sustainable and resilient cities: Theories, strategies, and best practices for green infrastructure. In V. Novotny, J. Ahern and P. Brown (Eds.), *Water Centric Sustainable Communities: Planning, Retrofitting, and Building the Next Urban Environment* (pp. 135-176). New York, NY: Wiley.
- Ahern, J. (2011). From fail-safe to safe-to-fail: Sustainability and resilience in the new urban world. *Landscape and Urban Planning*, 100(4), 341-343. doi:10.1016/j.landurbplan.2011.02.021
- Angelidou, M. (2014). Smart city policies: A spatial approach. *Cities*, 41, S3-S11. doi:10.1016/j.cities.2014.06.007
- Angelidou, M. (2015). Smart Cities: a conjuncture of four forces. *Cities*, 47, 95–106. doi:10.1016/j.cities.2015.05.004
- Angelidou, M. (2017). The role of smart city characteristics in the plans of fifteen cities. *Journal of Urban Technology*, 24(4), 3-28. doi:10.1080/10630732.2017.1348880
- Angelidou, M., & Psaltoglou, A. (2017). An empirical investigation of social innovation initiatives for sustainable urban development. *Sustainable Cities and Society*, 33, 113-125. doi:10.1016/j.scs.2017.05.016
- Beilin, R., Reichelt, N., & Sysak, T. (2013). Resilience in the transition landscapes of the peri-urban: from 'Where' with 'Whom' to 'What'. *Urban Studies*, 52(7), 1304-1320. doi:10.1177/0042098013505654
- Carpenter, S., Walker, B., Anderies, J. M., & Abel, N. (2001). From metaphor to measurement: Resilience of what to what? *Ecosystems*, 4(8), 765-781. doi:10.1007/s10021-001-0045-9
- Collier, M., Nedović-Budić, Z., Aerts, J., Connop, S., Foley, D., Foley, K., Newport, D., McQuaid, S., Slaev, A. & Verburg, P. (2013). Transitioning to resilience and sustainability in urban communities. *Cities*, 32, S21-S28. doi:10.1016/j.cities.2013.03.010
- Cumming, G. S. (2011). Spatial resilience: Integrating landscape ecology, resilience, and sustainability. *Landscape Ecology*, 26(7), 899–909. doi:10.1007/s10980-011-9623-1
- Desouza, K. C., & Flanery, T. H. (2013). Designing, planning, and managing resilient cities: A conceptual framework. *Cities*, 35, 89–99. doi:10.1016/j.cities.2013.06.003
- Eraydin, A., & Taşan-Kok, T. (2013). Introduction: Resilience thinking in urban planning. In A. Eraydin & T. Taşan-Kok (Eds.), *Resilience Thinking in Urban Planning* (pp. 1-16). doi:10.1007/978-94-007-5476-8