GREEN INFRASTRUCTURE AND ENHANCEMENT OF URBAN RESILIENCE. DELINEATION THROUGH INTERVIEWS WITH EXPERTS

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ABSTRACT

The aim of this paper is to investigate the contribution of green infrastructure (GI) to the enhancement of urban resilience in Greece. GI can be a valuable policy tool to promote sustainable urban development, as it has the potential to offer multiple benefits through the services and functions performed within ecosystems, and to enhance urban resilience, by creating more stable and dynamic environments. It is in place to improve health conditions and to positively affect the probability, intensity, and severity of the social, economic, and environmental impacts of disastrous events, such as natural disasters and extreme climate events, on local communities. Empirical research was carried out based on a semi-structured questionnaire, setting the ground for discussion with experts, having as an end-goal to acknowledge the existing deficiencies and to provide insight into the necessary actions towards improving the relevant policies and strategies in Greece. The research revealed deficiencies relating, among others, to the accessibility to GI, the incorporation of the 'networking' principle into urban policies and practice, the implementation of risk prevention planning and the cooperation among the responsible authorities. Nonetheless, it is widely accepted that ensuring the sustainability and resilience of cities is directly linked to the presence, quality, and function of GI. Training the involved stakeholders, strengthening the cooperation between them, formulating a comprehensive formal strategy, and establishing a monitoring and evaluation system of indicators, would contribute to the pursue of this objective.

KEYWORDS

Green Infrastructure; Sustainable urban development; Urban resilience; Urban policies; Greece

1. INTRODUCTION

The high urbanization rates in recent decades, combined with the reckless use of natural resources, have led to increasingly severe environmental problems worldwide [1]. Large urban centers are faced with the risk of environmental degradation and the occurrence of phenomena such as natural disasters and extreme climate events. The intensity and pace of such events are constantly increasing and are directly linked to climate change [2], which affects contemporary societies on several levels: environmental, social, and economic.

Green Infrastructure (GI) is considered an effective mode to manage these contemporary challenges [3]. GI, as originally defined by Turner in 1995 [4], concerns infrastructure which extends on a larger scale, runs through the city, and contains the whole system of green spaces within the city's boundaries. Two decades later, the European Commission

adopted the following definition: "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 ecosystems are concerned) and other physical features in terrestrial (including coastal) and marine areas. On land, GI is present in rural and urban settings" [5]. All in all, to date, there is no widely acknowledged definition of GI in the literature. However, according to the European Environmental Agency [6], there are underlying features accepted by all disciplines using the term. These include connectivity, multifunctionality and smart conservation. The term is used for "a network of green features that are interconnected and therefore bring added benefits and are more resilient. Another common feature is the aim to either protect or develop such networks". The importance of GI lies in the quality of 'functional interconnectivity', which sees beyond the single function of a green asset and brings added benefits.

GI has the potential to benefit human populations, contributing to more sustainable urban development. This is achieved when GI is founded on healthy ecosystems, which offer multiple benefits and functions. These functions may comprehend an environmental dimension, such as the conservation of biodiversity or adaptation to climate change or the drainage - water reuse process; a social dimension, such as the presence of green spaces and social interaction; and an economic dimension, such as the increase in property values. It is this multi-functional character of the GI that distinguishes it from the common 'grey infrastructures', which usually satisfy a single need, performing a single function, without contributing to the wider social, environmental, and economic context [7].

GI is, to some extent, in place to strengthen urban resilience. A city's resilience is defined by the ability of its individuals, institutions, businesses, and systems within the community to survive, adapt and grow despite the chronic stresses or acute shocks it experiences [8]. Resilient public spaces can be defined as those open spaces that contribute in enhancing the overall resilience of the city, as urban ecosystems on various aspects; reduce the risk and vulnerability in acute shocks (e.g. earthquakes, floods, terrorist attacks and more recently air-born pandemics) and to face efficiently chronic stresses (mitigate the effects of climate change, improve the urban environment and enhance social cohesion). In this context, green infrastructures, which consist of natural and artificial structures, serve specific goals of resilience, such as improving health conditions, mitigating the effects of climate change and natural disasters, act as secure spaces in cases of acute shocks etc. The proper functioning of the ecosystems plays a key role in mitigating the effects of disastrous events, while at the same time it contributes to the reduction of social, economic and environmental impacts on the local community. It is worth to note that resilience depends not only on how infrastructure is designed and implemented, but also on how it is co-created, co-managed and integrated into complex systems [9].

This research explores the possible contribution of GI to the enhancement of urban resilience. The end-goal is to acknowledge the existing deficiencies in Greece and to provide insight into the necessary actions towards improving the relevant policies and strategies.

2. METHODOLOGY

The empirical research was carried out based on a semi-structured questionnaire, setting the ground for discussion with experts (four academics and one municipal official) with experience in the field of GI and/or urban resilience.

The main issues for discussion were: i) the design of GI in Greece in relation to the citizens' accessibility, ii) the degree to which the design of GI in the country corresponds to the principles of 'functional connectivity' and

networking, iii) the need for cooperation, awareness raising, skills development and knowledge exchange between professionals operating at different levels and planning scales, iv) the degree to which the government and development organizations embrace a preventive / precautionary planning approach in respect to the management of potential disaster risk and the contribution of such an approach to sustainable urban development and urban resilience, v) the role of GI -as a strategy tool- in avoiding or reducing the effects of natural / man-made disasters, vi) the existence (or not) of a strategic plan that integrates GI in a way that contributes to the conservation, protection and rehabilitation of ecosystems, vii) the specific qualities of GI design to enhance urban resilience, viii) the appropriate strategies and the role of different administrative levels, x) the existence (or not) of a monitoring and evaluation system, x) the role of the involved actors and citizens in the design, use and management of these spaces.

3. RESULTS AND DISCUSSION

This section summarizes the main views of experts and the results obtained through this empirical research.

The experts reported that there are deficiencies in the accessibility to GI in Greek cities, mostly in large urban centers, which relates, on the one hand, to the low provision of green space per inhabitant and, on the other, to the way urban green spaces have been designed and distributed. This is even more evident in cities with historic centers, whose urbanization took place in the 19th and in the early 20th century. Apart from the limited quantity -in relation to the population needs- of urban green spaces, the existing green infrastructure usually does not meet satisfactory connectivity or accessibility, resulting in inadequate public access. As experts highlighted “in some cases the distribution of these spaces was random”, lacking a wider policy framework. They were designed individually, limited mostly by proprietary conditions on the urban land, with little – or no – integration with other green areas or other functions. Additionally, a significant part of green spaces does not meet its role to ensure the conservation, protection, and restoration of ecosystems, and consequently to maximize the benefits that can potentially arise.

Nonetheless, in recent years, this approach has started to be reversed, at least on a conceptual level. Perceptions of considering green spaces as small ecosystems within a larger complex urban ecosystem have come to the fore, along with the recognition of the ‘multi-functional’ value of each urban green space. Relevant policy documents do exist; however, there is still a gap between policy approaches and actual planning and/or implementation, and an inadequacy to comprehend the issue of ‘scale’ into GI’s planning and design (i.e. each city or urban area has different needs according to its size). Additionally, it seems that whether the provisions regarding GI planning are a priority or not depends on the political priorities of each government. It should be noted that this is a common phenomenon in Greece: every change in the government leads to substantial changes in planning policy.

The experts were asked to take a stand on the contribution of proper management of potential disaster risk, through the preventive / precautionary planning approach, on achieving sustainable urban development and enhancing urban resilience. Furthermore, they were asked to express their view on the extent to which governments and the various development organizations are proactive in approaching urban planning and in managing projects. The starting point for this part of the discussion was the acknowledgment that in recent decades, the losses related to natural disasters have significantly increased worldwide. Natural and man-made disturbances can have a devastating effect on a city's ability to meet even the most basic needs of its citizens as well as knock-on effects.

The experts argue that at the level of governments, either central or local, there is limited interest in precautionary planning,

which would aim at long-term results. In this sense, it is reported that there is lack of political will, but at the same time it is recognized that "society itself has a responsibility to ensure continuity" by searching for the appropriate mechanisms that would ensure continuity in public administration and a stable policy in this field. Initiatives such as the '100 resilient cities' Programme, 'pioneered' by the Rockefeller Foundation, can assist urban governments and stakeholders to become more resilient to physical, social and economic challenges and decrease vulnerabilities. Athens and Thessaloniki, the two metropolitan centers of Greece, had joined the '100 Resilient Cities' Programme, to develop and implement their resilience strategies. There are also significant available tools that fall within the precautionary approach or the encouragement of the active participation of citizens, such as the emergency notification application for extreme temperatures, called EXTREMA, or the protection of new planted urban trees by the citizens themselves, through the project "Adopt a tree". EXTREMA is an application that offers real-time surveillance and evaluation of health risks during heat events, by means of a Dashboard for Authorities and a mobile app for the general public. The Dashboard app can help municipal authorities manage heat waves while providing residents with personalized heat risk assessments on their phones [10]. "Adopt a tree" on the other hand, aims at the successful protection and maintenance of new-planted trees in the streets or parks of the Municipality of Athens, through the participation of citizens in the preservation of their trees and also through their direct interaction with municipal officials via a mobile application, aiming at safeguarding the resilience of urban green [11].

On the urban planning level, however, it appears that the implementation of risk prevention planning is not an easy task, due to the particularities of the urban planning legislation, and moreover the inability in some cases to comply with it, the planning tradition allowing arbitrary development and the dominant characteristics of private ownership of property. In this context, the legal and financial requirements for compensation after the expropriation or after the demolition of arbitrary buildings (e.g. buildings constructed close to embankments) cannot always be met. Precautionary planning is more easily accepted by citizens in cases where the risk of a natural disaster is systematically repeated over time.

International literature and practice highlight that the avoidance or reduction of the negative effects of risks can occur through the systematic development and implementation of relevant policies, strategies and practices [12, 13]. In this context, experts agreed that the presence of GI in cities can work beneficially. Green spaces diversify the urban landscape, offering a greater variety of functions / uses, which falls within the principles of sustainability and enhances urban resilience. They could also be used as gathering places or as providers of makeshift accommodation in case of acute shocks. Also, the benefit could be indirect: improving the quality of life of the inhabitants may increase the sense of responsibility for a place and activate the will / desire for restoration after a natural or anthropogenic disaster.

It is acknowledged that the role of GIs is crucial for the creation of a balanced environment, able to adapt / respond to the respective disturbances – natural disasters / extreme phenomena – and for this reason they have been brought in discussion in recent years. Combined with other practices they can deal with such situations and reduce their adverse effects. The major challenge lies in ensuring their proper incorporation into urban planning policies and plans as well as in acquiring the necessary financial resources. As for the first of these challenges, it is recognized that GI should be incorporated both into urban planning and environmental policy, it should include the notion of the 'ecosystem' and it should be designed and planned in an integrative way, in order to constitute a network running through the city. This in turn, would help achieve better accessibility. As for the second challenge, it is stated that during the forthcoming

programming period 2021-2027 financial resources will be directed to large urban development actions and interventions, rather than piecemeal approaches, which will incorporate the rationale behind green infrastructure as brought out in this paper, i.e. in an integrative way. Emphasis is also given on the public sector's efforts to involve the private sector in the process of shaping green infrastructure. This is a concrete policy, which however is not easy to achieve. This can be attributed to the lack of a cooperation culture in the country and more specifically of public-private partnerships' experience, along with the lack of sufficient and straightforward legislation to establish and purse such partnerships [14]. Lastly, an incentive policy is required to involve the citizens into the shaping of GI and further into its maintenance and management. While urban planning legislation makes provisions for the potential involvement of citizens in such a process, in practice there is limited or even no possibility of utilizing the incentives and tools provided, mainly due to the peculiarities of private property of ownership in Greece.

In all, the presence of GI is believed to be in place to enhance the resilience of a city, provided specific policies are adopted. The factors enhancing resilience include, inter alia, the multi-center and multi-level governance, the creation of endogenous sources of new knowledge and their connection to external sources, the encouragement of diversity, the strengthening of networking and learning and the establishment of a climate of creativity and innovation. Collective action and participatory planning fall within the above concepts and reinforce positive elements of a city's resilience.

As for the role of each level of government in relation to the strategies that need to be adopted, clear-cut competencies can be identified. What is missing is the cooperation between them. The central government forms the framework, sets the broader objectives and strategies, while the local government, being closer to the society and its local needs, acts accordingly, specifying the goals and strategies into more concrete actions and projects. However, in many cases, although the local government has the competencies to make decisions, these are not eventually approved by the local government. Adding to this, the local government may lack financial resources. These views raise discussions around "bottom-up" approaches to decision-making against "top-down", which falls within the field of vertical cooperation and governance, i.e. between levels of government.

It is generally accepted by the experts interviewed that a monitoring and evaluation indicators system is essential to monitor the impacts of GI on urban resilience and give feedback to the design of policies and actions. This approach could be incorporated into a wider system of indicators monitoring the adaptation to climate change or the cities' urban resilience in a broader sense (environmental, social and economic).

The concept of GI has been only recently incorporated into the urban planning policy. The interpretation of policies into comprehensive and concrete practices requires sufficient knowledge and leads to the need for training of both the responsible public administration executives and urban planners. According to some views, this presupposes a legal obligation for training (i.e. provision in the legal framework). At the same time, the role of the citizens can be significant in contributing to sustainable urban development and resilience. It is reported that, even though citizens may not understand urban resilience as a concept, they are able to experientially perceive it. There are councils though which citizens can have a voice and pressure local governments to take actions towards enhancing urban resilience. This process also helps build a feeling of co-decision and co-creation in achieving collective interest.

4. CONCLUSIONS

Contemporary cities are sources of stress, vulnerable to both expected stresses and

unexpected shocks (climate change effects, pandemics, economic instability, disorder, terrorism etc.) that can lead to social breakdown, natural disaster or economic poverty. Cities need to ensure that their development strategies and investment decisions enhance rather than undermine their resilience. If governments, investors, policymakers and the private sector collectively support and promote more resilient cities, there must be a common understanding of what constitutes a resilient city and how it can be achieved. In this context, green infrastructure is considered a valuable urban asset and also a policy tool to promote sustainable urban development and enhance urban resilience.

This research explored the possible contribution of GI to the enhancement of urban resilience in Greece. It initially revealed the deficiencies in the accessibility to GI due to the senseless planning and distribution of urban green spaces in most Greek cities as well as the lack of incorporating the principles of 'networking' or 'multi-functionality' into the urban planning policy and practice. In addition, it revealed that the way natural ecosystems function is not properly understood by the stakeholders, to give the required importance to the GIs.

It was also shown that, in contrary to other countries worldwide, it is not easy to implement risk prevention planning in Greece due to particularities of the urban planning legislation and the dominant characteristics of private ownership of property. The limited cooperation and sometimes the fear of interaction between the responsible authorities was also highlighted.

Nevertheless, it is recognized that the presence of GI works beneficially. It diversifies the urban landscape, offering a greater variety of functions / uses, which falls within the principles of sustainability, while the variety of activities helps in the resilience of urban systems. Important issues to be considered are: i) the adoption of specific policies and the formulation of concrete strategies and actions that directly relate GI with urban resilience, ii) the assurance of financial resources especially at the local level, iii) the design of appropriate urban planning tools and iv) the citizens' training and participation in the decision-making processes and relevant actions.

Ensuring the sustainability and resilience of cities is directly linked to the presence, quality and function of GI. Training the involved stakeholders, strengthening the cooperation between them, ensuring active citizen participation, formulating a comprehensive formal strategy, and establishing a monitoring and evaluation system of indicators, would contribute to the pursue of this objective.

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