

ENGAGING STAKEHOLDERS IN CLIMATE CHANGE ADAPTATION PLANNING AT THE MUNICIPALITY OF PENTELI.

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Abstract

Urban areas are particularly vulnerable to the increasing natural disasters due to their high population density, infrastructure concentration, and socioeconomic complexity. This research aims at understanding the role of spatial governance and engaging stakeholders in adapting to the effects of climate change and reducing the risk of disasters.

The Quick Risk Estimation Tool (QRE) was applied to the case study area, the Municipality of Penteli. The tool, by the UN for Disaster Risk Reduction (UNDRR) for the Making Cities Resilient Campaign 2030, is an assessment of the risks that threaten the area and the measures/strategies applied to deal with them, based on the Stakeholder's views. The purpose of the tool is a multi-stakeholder engagement process to establish a common understanding and can be used as a guide for the analysis of the region's characteristics, weaknesses, and strengths. The research was conducted with interviews with selected stakeholders of the area.

The results of the research showed that the risks that mainly threaten the area, based on the stakeholders' view, are those of wildfire and snowfall, with those of earthquakes and flood following. A strong differentiation of the stakeholders' opinions, especially in relation to the evaluation of the level of actions and measures that are in place was observed. This fact can be attributed to the lack of engagement and participation of the stakeholders in the planning process.

The conclusions highlight the importance of governance in spatial planning in a framework of transparency and communication and the role of participation in creating a common vision and accomplishing resilience. The use of the QRE Tool in the case of Penteli aimed to raise awareness among stakeholders about the adaptation to natural disasters and to promote risk reduction parameters in planning processes. The absence of governance principles results in strategies and plans without coordination and coherence, while the gap between citizens and the local administration grows, due to lack of trust and constant questioning. By integrating disaster risk management into the planning process cities may respond to these challenges and minimize harm.

Key words: *Urban Resilience, Spatial Planning, Disaster Risk Reduction, Spatial Governance, Municipality of Penteli*

Introduction

Climate change has emerged as an environmental issue in recent decades and the related dialogue on addressing and adapting to its consequences has created a range of policies that

concern the broader environment and the impacts of human activities on it. Mitigation aims to address the causes and reduce and stabilize greenhouse gas levels in the atmosphere to prevent climate change. On the other hand, adaptation involves anticipating and managing the extreme effects of climate change, taking measures to mitigate present and future impacts and minimize potential damages. (Davoudi et al., 2009; IPCC, 2018; Richardson et al., 2011)

As cities continue to expand, they are more exposed and vulnerable to the effects of climate change. Natural disasters are posing a serious challenge as they have become more frequent and intense over the years, therefore the need to take effective action is imperative. The terms “adaptation planning” and “disaster risk management” are increasingly being used in the context of making urban areas resilient to hazards. Specifically, adaptation is defined as “*the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities*” (IPCC, 2018). Disaster Risk Management is “*the processes for designing, implementing, and evaluating strategies, policies, and measures to improve the understanding of disaster risk, foster disaster risk reduction and transfer, and promote continuous improvement in disaster preparedness, response, and recovery practices, with the explicit purpose of increasing human security, well-being, quality of life, and sustainable development.*” (IPCC, 2018)

The factors that increase the disaster risk of an area and its vulnerability to natural disasters can vary from social-economic to topological and urban characteristics. For many cities and urban areas, their exposure to hazards is unavoidable, as the factor that makes them vulnerable is their geographical and geomorphological characteristics. For example, a city that is located near the sea or a river, is prone to floods or erosion. Furthermore, cities have been rapidly expanding, which has resulted in their unplanned development and poor land management. Basic infrastructure and critical public services also play an important role and can be vital in preventing a hazard or minimizing their effects. The unplanned placement of basic infrastructure near hazard-prone areas can significantly increase the vulnerability of the area. In all, resilience depends largely on the resources of a city and its *capacity* to adapt to the hazards that threaten the area. Capacity is defined as “*The combination of all the strengths, attributes and resources available within an organization, community or society to manage and reduce disaster risks and strengthen resilience. Capacity may include infrastructure, institutions, human knowledge and skills, and collective attributes such as social relationships, leadership and management*”, (UNDRR, 2009). Therefore, integrating risk reduction parameters in the planning processes is critical for preventing current and future natural disasters and is important to happen at all levels and processes of planning. (Asian Development Bank, 2016; Asian Disaster Preparedness Center, 2011; DiMSUR, 2016; UNDRR, 2009; United Nations Human Settlements Programme, 2011)

The integration of disaster risk reduction strategies into the planning process is critical for enhancing urban resilience and sustainable urban development. Disaster Risk Management (DRR), according to international organizations, such as the U.N. for Disaster Risk Reduction, constitutes the primary approach to address and prevent natural disasters. Its integration must occur at all levels and stages of planning, utilizing laws, policies, regulations, as well as plans. According to UNDRR, the concept of DRR is an extension of the broader term “risk management” and involves the systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies, and improved capacities for risk mitigation in order to reduce the negative impacts of risks and the likelihood of disaster. (Earthquake and Megacities Initiative, 2015; UNISDR, 2009)

The contribution of local government and stakeholders is necessary to the adaptation process, in a framework of spatial governance. The Sendai Framework in priority 2, emphasizes strengthening disaster risk governance to manage the disaster risk. Spatial governance constitutes an organizational form of collective action, which is spatially oriented

and aims at improving spatial cohesion, and sustainable and balanced development at all planning levels. It is based on horizontal and vertical partnerships among levels of government or governmental and non-governmental organizations, seeking to achieve common goals and visions. Specifically, according to the "White Paper on European Governance", "Participation" constitutes one of the fundamental principles of the spatial governance approach. Its objective in policy formulation and execution is to ensure widespread participation in every stage of the planning and decision-making processes, thereby fostering confidence in the outcome, acceptance of the plan and effective implementation (EC, 2001; United Nations, 2015; United Nations International Strategy for Disaster Reduction, 2015; Wassenhoven et al., 2010).

Subsequently, stakeholders, by engaging in the planning process for disaster risk reduction, can better understand the concepts of hazards, vulnerability, and risk, develop consensus among them, create a common vision and contribute to the process. In addition, by having an essential role in the planning process, stakeholders share control over decisions that affect them and encourage commitment. To achieve coordination, various stakeholders across sectors and all levels should participate in this process, as they attach different levels of attention to disaster risk and different perspectives. Those can be government institutions, non-government organizations, community-based organizations, academia, the media and citizens themselves. (Earthquake and Megacities Initiative, 2015; Giordano et al., 2013; Suri et al., 2020)

The objective is to promote bottom-up planning and horizontal and vertical collaborations among all levels and sectors of management. Thus, through participation, awareness and coordination, there will be transparency in the decision-making process and the administration will inspire trust and accountability. Consequently, by integrating risk reduction parameters in urban planning and engaging stakeholders in this process, cities will achieve better prevention, preparedness, and response to hazards. (United Nations, 2015; United Nations International Strategy for Disaster Reduction, 2015)

The Making Cities Resilient 2030 campaign, or MCR2030, is a multi-stakeholder initiative developed by United Nations for Disaster Risk Reduction (UNDRR), that aims to ensure cities become inclusive, safe, resilient, and sustainable by 2030. Through sharing knowledge and experiences, access to tools and guides, MCR2030 supports cities on their journey to reduce risk and build resilience. (UNISDR, 2022)

Portugal is an example of a country that aims to ensure the achievement of global frameworks such as the Sendai Framework for Disaster Risk Reduction or the Sustainable Development Goal 11 (SDG11) "Make cities and human settlements inclusive, safe, resilient and sustainable". The National Strategy for Adaptation to Climate Change aims to raise awareness about climate change and its impacts, as well as to develop adaptation policies at the national level. In addition, the National Risk Assessment is a report that identifies the risks of the country, evaluates the characteristics that make it vulnerable, and assesses the degree of vulnerability and severity of the disaster for each risk. It serves as a guiding document, as it suggests strategies aimed at mitigating these risks and promotes the participation of stakeholders. The plan covers the local, regional, and national levels, and the participation of municipalities, associations, and individual citizens is considered essential. (National Platform for the Reduction of the Risk of Disasters (PNRRC), no date; Portugal, 2015, UNDRR, 2009)

Many Portuguese municipalities have joined the MCR2030 campaign, of which Amadora, among others, is now a Resilience Hub, as they have completed all stages of the program and have met the conditions. Resilience Hubs are local authorities that have an established track record in disaster risk reduction and resilience, and their role is to support and guide other municipalities. Their aim is to promote cooperation between cities and

stakeholders and share knowledge and experiences valuable for the development of each region. (Amaratunga et al., 2019; Santos et al., 2020; Portugal, 2015)

The Municipality of Amadora is an example of good practice and a model city, according to the MCR30 program. Despite being a small city, Amadora has the highest population density of any municipality in Portugal. The rapid development and urbanization of the city through the years have led to pressure on land and services, poor local governance, and insufficient participation by stakeholders in planning and urban management. Facing the risk of flash floods, urban fires, industrial fires, landslides, and storms, Amadora joined the MCR2030 campaign and formed a multidisciplinary team with stakeholders from different municipal departments, with the aim to adjust to these challenges, bring awareness and commitment to the planning process. The team included more than forty stakeholders, each having a specific role, such as developing studies about risk and vulnerability assessments, promoting contacts with local associations and citizens' groups to increase their awareness, providing data, organizing training activities and awareness about risk and disaster. Aiming to adapt and reduce the risks of those disasters, the city implemented several policies and plans, followed the steps and goals of the program, and ensured the participation and awareness of residents in this process. (Amaratunga, Sridarran and Haigh, 2019; Santos et al., 2020; UNDRR, 2005;)

In this research a tool of the Making Cities Resilient Campaign 2030 was applied at the Municipality of Penteli, in Attica, Greece. The Quick Risk Estimation Tool (QRE) consists of an assessment of the risks that threaten the area and the measures/strategies applied to deal with them, based on the Stakeholder's views. The purpose of the tool is a multi-stakeholder engagement process to establish a common understanding and can be used as a guide for the analysis of the region's characteristics, weaknesses, and strengths.

The case study area

In Greece, an extensive dialogue has taken place in recent years regarding the adaptation to climate change. Relevant strategic plans have been formulated at a national and regional scale, such as the National Adaptation Plan to Climate Change and the Regional Adaptation Plans to Climate Change. The National Plans set the priorities and policy measures, in a wide range of development and economic activities, while the regional plans identify and prioritize the necessary measures and actions at local/regional level, including measures concerning management plans for risk prevention, and the coordination of the competent ministries-agencies. The Regional Plans concern the 13 Regions of Greece and are obligatory. Also, a recent institutional framework (L.4662/2020) includes a series of General Civil Protection Plans for Emergency Response and Immediate Management of the Consequences of various disaster events such as Floods, Forest Fires, Earthquakes, Technological Accidents, and for the response to a Volcanic Eruption in Santorini. (Asprogerakas and Tasopoulou, 2021; Cartalis et al., 2017, Cartalis et al., 2021; Markada and Asprogerakas, 2020; Region of Attica, 2020).

According to research by Asprogerakas (2022), planning for civil protection starts with a risk assessment for a given area. The above-mentioned civil protection plans have a certain spatial dimension and include limited actions that could be integrated into spatial planning tools:

- the identification of sites for the temporary deposition of solid waste, bio-waste and rubble resulting from the disaster event.
- the identification of places where citizens may gather for the subsequent organized evacuation.

- the identification of sites for the reception and accommodation of persons affected by an earthquake (camping sites).
- the adaptation of the road network to allow the evacuation of the affected persons without impeding the access of emergency and relief vehicles.

These actions are mainly local in focus, and municipal authorities play an important role, in facilitating their integration into spatial planning (Asprogerakas E. & Tasopoulou A, 2024).

The Municipality of Penteli is located in the northeastern suburbs of Athens, Greece. It is an area of 28.878 km² with 34.934 residents. Penteli has various geomorphological features and is characterized as a peri-urban area, consisting of urban centers and settlements. It is adjacent to and surrounded by Mount Pentelikos and crossed by the estuary of Chaladri stream. Penteli was formed in 2011 by the merger of the former Municipalities of Melissia, Nea Penteli and Penteli, which are now communities. Melissia is the most densely populated of the communities and is where the main administrative, business, and public services are located. Whereas the communities of Nea Penteli and Penteli can be described as more peri-urban areas and sparsely populated areas.

Penteli's Municipality has a long history with natural disasters, due to its location near Mt. Pentelikos. It has been affected many times through the years by forest fires, in the summer, or heavy snowfall in the winter. These disasters have caused a significant impact not only on the environment and the economy of the area, but also on the lives of its residents. Spatial planning in the municipality is under revision. The Regional Adaptation Plan to Climate Change of Attica (2022) does not provide specific local directions for the Municipality, however, there are directions about the massifs of Attica. Specifically, it sets as a priority "*the protection, restoration, and enhancement of the natural environment and landscape that have been affected by major wildfires.*" Also, in relation to special governance, the focus is mainly on informing and raising awareness of the public and the policymaking and implementation bodies. (Region of Attica, 2020)

Methodology - The Quick Risk Estimation Tool

This research aims at addressing the role of spatial governance in adapting and preventing natural disasters, specifically the role of stakeholders and the local government in the planning process. The Quick Risk Estimation Tool (QRE) has been used in the initial stages of the MCR2030 program in order *to identify current and future risks/ shocks and expose threats to both human and physical assets*. It is not a full-scale risk assessment, but rather a multi-stakeholder engagement process to establish a common understanding. The Tool was adapted for the research purposes as it is typically to be used in a workshop environment in a multi stakeholder approach. It is full-scale available for the cities that participate in the Making Cities Resilient 2030 (MCR2030). (UNISDR, 2022; Quick Risk Estimation Tool | Making Cities Resilient, no date)

The Tool allows users to input information about their city or region and collects data on various risk factors for hazards, such as exposure, vulnerability, and coping capacity. The information is inputted by assessing those values in different scales, for example from extremely unlikely to happen to inevitable. Once the data are inputted, the tool analyses the risk profile of the selected area to each selected hazard. It assesses the risk by considering the relation among exposure, vulnerability, and coping capacity, providing insights into the overall vulnerability rating, likelihood ranking score and severity rating. According to the tool's guidelines, its potential users can be the local administration and authorities of the city, or the stakeholders. (MCR2030). (UNISDR, 2022; Quick Risk Estimation Tool | Making Cities Resilient, no date)

The QRE Tool was applied in the case study area, in the scope of assessing and understanding the disaster risks of the area and engaging stakeholders in the process. Its application in a workshop environment would produce more extensive and thorough conclusions.

The research was conducted through ten structured interviews with selected stakeholders of the Municipality. Those are representatives from the Pentelis Civil Protection department, three environmental associations and the Municipality’s Volunteer Firefighters Association. The research started on 25 January 2023 and was completed on 16 February 2023.

Each stakeholder had to complete an assessment of the area for each hazard according to their opinion. The questions the stakeholders were asked indicated by the instructions for use of the tool. Specifically, the first step is to identify the main hazards that threaten the region based on their view. Secondly, to assess the exposure of the region to each selected hazard, then the vulnerability of four sectors (Infrastructure, Productive Sectors, Basic Services, Human and Social Aspects) and finally to assess the current level of response measures undertaken or in place.

Hazard family	Perils	Exposure rating	Vulnerability rating				Total vulnerability rating 1 (low) - 100 (high)	Current level of response measures undertaken or in place	Likelihood ranking score 1 (low) - 10 (high)	Severity rating 1 (low) - 100 (high)	Risk matrix output
			Infrastructure	Productive sectors	Essential or basic services	Human and social aspects					
H1 - Geophysical											

Figure 1: The Quick Risk Estimation Tool, Source: Quick Risk Estimation Tool | Making Cities Resilient, no date, and Editing Author.

The risks that were selected indicatively for the responders were those of fire, flood or extreme weather, and earthquake. The selection was based on the city's current understanding and its historical data on previous natural disasters. However, the interviewees were given the option to report any additional risk if deemed necessary. Half of the Stakeholders singled out heavy snowfall as a separate category from severe weather. Thus, the final selected risks to which the study area is prone, according to the stakeholder’s answers, were those of fire, flood, heavy snowfall, and earthquake.

Based on the assessments above the QRE tool auto-populates two final numerical values, the Likelihood Ranking Score and the Severity Rating. According to the Tool’s manual:

- **The Likelihood Ranking Score:** “refers to the likelihood of the event occurring in comparison to the other assessed events in the specified location, based on the location's exposure and vulnerability to that event, and the current actions and measures undertaken. The higher the ranking score, the higher potential requirement for action”. It is important to note that this score is not a statistical measure of probability but a ranking score, to enable prioritization of hazards across all assessed hazards.
- **The Severity Rating:** “refers to the impact and consequence level that a hazard would have on the location under study and its community”.

Figure 2: The Quick Risk Estimation Tool, Source: Quick Risk Estimation Tool | Making Cities Resilient, no date, and Editing Author.

Based on those two values above, hazards are allocated to the 'Risk Matrix' ranging from Very Low to Catastrophic.

Results & Discussion

Likelihood ranking		Very Low	Low	Moderate	High	Very High
Likelihood ranking score		0 - 2	2 - 4	4 - 6	6 - 8	8 - 10
Severity Weighted average severity score (based on responses provided for vulnerability, exposure and response measures)	Insignificant 0 - 10	VL1	VL2	L3	L4	M5
	Minor 11 - 25	VL2	L3	L4	M5	M6
	Moderate 26 - 50	L3	L4	M5	M6	H7
	Major 51 - 75	L4	M5	M6	H7	H8
	Catastrophic 76 - 100	M5	M6	H7	H8	VH9

Figure 3: The Risk Matrix table, Source: Quick Risk Estimation Tool | Making Cities Resilient, no date, and Editing Author.

The hazard with the highest values and therefore with the high risk, according to the stakeholder’s opinion, was that of fire. The hazard with the lowest values was that of floods. Specifically:

- The hazard of **fire** shows the higher Risk Output and is located on the Matrix table as M6, as based on the Severity rate it is classified as Moderate and based on the Likelihood rate is High. According to the Tool this means that there is a reasonable chance of occurring at least once or has occurred twice in the last 5 years.
- The hazard of **heavy snowfall** is located on the Matrix table as M5. Based on the Severity rate heavy snowfall is classified as Minor, while based on the Likelihood rate is classified as High.
- The hazard of **earthquake** is located at L4 with Moderate Severity Rate and Low Likelihood rate. This means that the hazard might occur at least once or has occurred once within the last 5 years.
- Lasty, the risk of **flood** is located at VL1 with Insignificant Severity Rate and with Low Likelihood rate. This means that the hazard is not expected to occur or may occur and has occurred once in the last 10 years.

Due to the area’s history with natural disasters, it is evident for the stakeholders to consider fire as the hazard that threatens the area the most. However, even though heavy snowfall does not have such permanent and catastrophic impact, the stakeholders value the hazard as a high risk one. This can be due to the frequency of occurrence of this hazard and the impact it has on their everyday life.

The following graph shows that stakeholders assess higher the exposure of the area to the hazard of heavy snowfall, than to that of fire. This can be due to the frequency of occurrence

of heavy snowfall as mentioned above. Conversely, fire is assessed with a higher vulnerability rate than that of snowfall. The Vulnerability Rate is the total of the vulnerability rate in each following sector: Infrastructure, Productive Sectors, Basic Services, Human and Social Aspects. Fire can cause catastrophic and permanent damage to all of the above. Local Urban Plans must include directions and measures for those sectors to increase resilience, such as, anti-fire and anti-flood infrastructures and measures, and increase education and information regarding adapting to natural disasters.

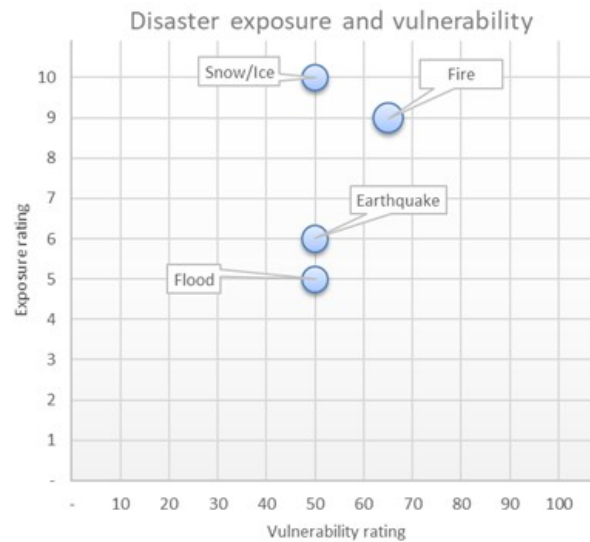


Figure 4: Hazard’s ranking based on their exposure and vulnerability rate, Source: Quick Risk Estimation Tool | Making Cities Resilient, no date.

The stakeholders were also asked to evaluate and rate the current level of response measures undertaken or in place. Based on the averages of the responses for each hazard, scores ranged from 3: Few measures in place to 5: Reasonable measures in place. The hazard of earthquake, even though the Municipality is characterized as of low seismic risk, had the lowest rate, followed by flood and fire (4: Some measures in force), while the hazard of snowfall had the highest score comparatively. Based on the interviews, it was observed that the answers among the respondents had a strong differentiation. However, it is important to mention that each interested party answered the questionnaire based on their own experience, knowledge, and familiarity with the concepts of risk and vulnerability, as well as based on their personal opinions. In addition, Penteli is a large Municipality with various characteristics, which can result in stakeholders not considering each factor separately, but rather assessing the area as a whole. For example, flood was assessed with a low exposure, likelihood, and severity rate, due to the Municipality’s location near the mountain, however the Chaladrion river passes through Melissia, a more densely populated area than the others, which lacks a completed anti-flood plan and infrastructure.

Furthermore, it was observed that the assessment of the level of response measures ranged in low ratings, from “Few measures in place (3)” to “Reasonable measures in place (5)”. This shows an overall dissatisfaction and lack of trust towards the local administration, which can be attributed either to the lack of effective plans and measures, or to the lack of awareness and familiarity with the planning process.

Conclusions

The QRE Tool was applied in the case study area, in the scope of assessing and understanding the risks of the area according to the stakeholder's opinion and engaging them in the process. It aims to raise awareness and create a discussion among stakeholders about the need to adapt to natural disasters and to promote risk reduction parameters in the planning processes. The role of the Risk Matrix is to show the threats and the strengths of the area, based on the user's view, allow comparison and prioritization among the hazards and to create a comprehensive picture of whether there is involvement and cooperation between actors. In this process, developing current and future risk scenarios based on the results of self-assessment will help the formation of future strategic and urban plans.

The results of the research revealed uncertainty and a distance between stakeholders and the local administration implying a lack of trust. In addition, the strong differentiation among the responder's answers, can be due to the unfamiliarity with the concepts of exposure, vulnerability, and adaptation planning, but also shows the need for discussion.

A comprehensive strategic plan on Municipality level should focus on long-term planning, including disaster risk reduction measures and actions, define roles and responsibilities and citizen participation. The focus should be not only on response and civil protection actions but rather include preventive measures and disaster risk reduction actions. Participation must become part of the planning process, to increase the trust to local authorities. To strengthen the strategies for reducing the vulnerability of the Municipality and integrate the factors of disaster risk in the planning process, it is important:

- to promote horizontal and vertical collaborations at all levels of administration and help create a common vision in achieving resilience,
- and to apply the principles of spatial governance in the planning process, such as participation and awareness, transparency, and accountability in the decision-making process. Those values will help develop consensus among the stakeholders and create a common vision.

"Disaster response" does not mean only "disaster management", but it is rather a cyclical long-term process. Developing a resilient and sustainable city requires a roadmap of actions and activities that are both implementable and feasible, yet precise and ambitious in their expected impacts. Many international organizations offer guides and tools for countries to ensure they become inclusive, safe, resilient, and sustainable. Decision makers should search for models that fit each case study and focus on the needs and issues of each area. The "Making Cities Resilient" initiative would be an opportunity for the Municipality of Penteli to commit to the implementation of these priorities and develop into a resilient city. It is crucial for cities to plan for long-term resilience, as urban risk has changed and is changing rapidly making their impact more intense.

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