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Adaptable Public Space, An Essential Parameter of a Resilient City and of Risk Prevention and Management, Case of Blida City – Algeria

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Abstract

With population growth, climate change and increasing risks, cities are becoming more vulnerable. Therefore, strengthening their resilience requires a strategic exploitation of public open spaces, beyond its traditional role, through its important potential for adaptability and mitigation. Our contribution aims to explore the role of public open spaces in the prevention and management strategies of major risks in Algeria (Blida). We proceed by evaluating the capacity of public open spaces to respond to risks situations through a reading of the proposed strategies by the Algerian rescue plan; Accompanied by an international case study which examines the strategies of the use of public open spaces in case of major risks. Finally, a fieldwork survey completes this reading. The conclusions of this research reveal an under-exploitation of public open spaces, that must be integrated into an emergency intervention scheme, while also identifying choice indicators for selecting adaptable public open spaces.

Keywords: Public Open Spaces; Adaptability; Disaster; Urban Resilience.

1. Introduction

For decades, pandemics, disasters and hazards have had a direct impact on our cities and regions, influencing the way cities are organized and operated.

According to Prescott-Allen, (2003), a livable city is one that provides quality of life conditions through human and ecosystem wellbeing. It's also a high-performance city where citizens feel safe, and where the resilience and health of basic urban components are crucial (Amen, 2021, Aziz Amen, 2022, Amen et al., 2023, Amen & Nia, 2020) . However, with population growth, climate change and urban concentration, the ecosystem is being disrupted, which increases the urban risks (Feng et al., 2015) that are manifested in different disasters and natural or technological hazards, while increasing the vulnerability of cities.

In this context, strengthening urban resilience and reducing the vulnerability of territories to these risks become the most important challenges and essential conditions facing today's cities to ensure quality of life, health and safety of the population, which requires an imperative conceptual adaptation of urban planning strategies.

Open Public Spaces (OPS), as a fundamental and inevitable component of the urban system of cities, are used by most planners, architects and designers to improve the quality of life and economic growth. It also has a primary interest in the organization and aeration of the urban fabric, aesthetic attraction, social interaction and environmental health, as well Jayakody et al., (2016) confirm that it has an interest in creating sustainable cities.

However, in a crisis situation, the public space is the first space to be involved, and its contribution to risk mitigation and disaster resilience strategies still not completely exploited in the development, planning and design of territories. This has been confirmed by Hossain, (2014) who states that the role of public open spaces in increasing the resilience of cities to disasters has not yet been fully discovered.

In the event of a disaster or an unpredictable risk, especially an earthquake, the open public space is the first space whose use is transformed and metamorphosed. It is the main pillar of the rescue and evacuation operations.

From this perspective, public spaces must meet multiple expectations to facilitate the management and organization of relief efforts in crisis situations. Vargas-Moreno et al., (2014) highlight that open public spaces have the potential to act proactively, contributing at multiple scales throughout the city to solve current and future problems. This contribution calls for a necessary conceptual and functional adaptation of public spaces to be designed not only to achieve a better quality of life but also to respond to the new challenges of adaptability related to the evolution of their use and the role that can play in prevention, mitigation and risk management as an efficient urban tool that strengthen the resilience of cities.

According to Vanderlinden et al., (2022), Adaptation is a process, not a state, thus, in the face of uncertainty and change in the world, we are not adapted, we adapt. In this context, our intervention focuses on the adaptability of integration open public spaces in the emergency response plan in Algeria. In this regard, two questions can be asked:

- what role can play the open public spaces in risk situations?
- what actions or measures for their adaptability and integration in the Algerian emergency plans?

This research aims to highlight the key role of OPS in strengthening the resilience of cities, through their integration into the strategies of prevention and management of major risks, taking as an example of study the case of the Wilaya of Blida in Algeria. In this context, the objective is to identify the functional and spatial indicators for the adaptability of open public spaces in major risks and consolidate the relation between OPS and risk management to effectively reduce the damage and impacts of a crisis on the reactionary and organizational level in order to ensure the security of population.

This document is structured into three parts. The first, consist on the literature reviews using international case study applied to two cities (Kobe and Mexico) to identify their strategies for using OPS in times of disaster. The second presents an overview based on an empirical study of the Algerian emergency plan (ORSEC plan) accompanied by a satisfaction survey. The third parts consider the results and discuss the main contributions of this paper.

2. Material and Methods

This paper aims to highlight the need for an urgent and effective response in disaster situations, where it is necessary to integrate and use the OPS. To conduct this ongoing research and answer the questions of the problematic, we adopt a methodology in 3 phases:

1. First, a literature review using international case study approaches and examples to examine their strategies for using public open spaces during disaster. Once identified, the information will be synthesized and classified according to the following categories:
 - Type of public open space used (OPSt)
 - Nature of use of the public open space (OPSu)
 - Function, role and activity performed in the public open space (OPSt)
 - Logic and advantage of the location of the public open space (OPSt)

The classification of strategic public spaces will be based on the number of functions performed by each space in order to observe its degree of adaptability. The results obtained by the analyses of international case study will be compared to the proposals of the Algerian ORSEC plan applied to the municipality of Ouled Yaich in order to reveal its gaps and failures in relation to the functional use of OPS during risk.

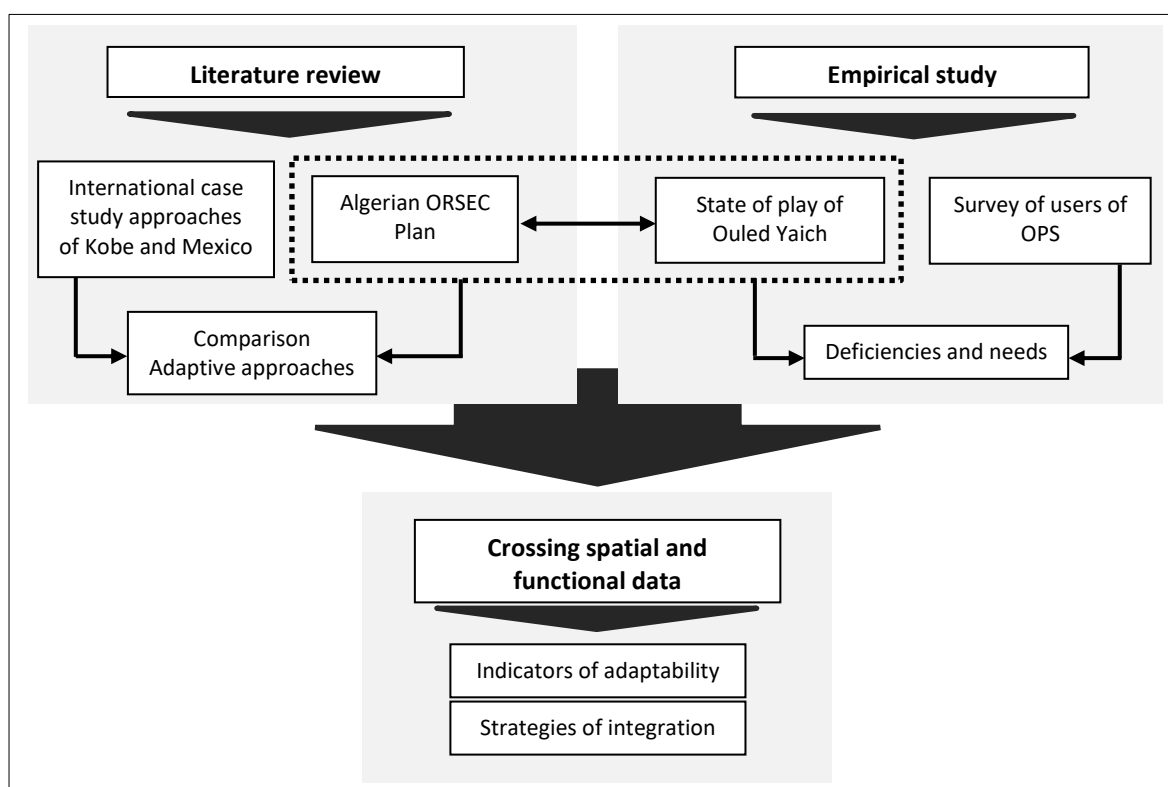


Figure 1. Structure of the methodology, (authors).

2. The second phase consists of an empirical study of the city of Blida through its municipality Ouled Yaich accompanied by a satisfaction survey through a questionnaire addressed to users of OPS. The study will assess users' satisfaction with the user of these spaces in times of crisis and their functional adaptability.

3. The third phase consists to the crossing of spatial and functional data to identify the adaptability indicators for reshaping public space to be flexible and adaptable in the face of major risks.

3. Results and discussion

The prospects of the sudden changes our territories are undergoing, especially with the ever-increasing natural risks, are prompting us to study new ways of optimizing and improving risk prevention and mitigation policies. According to Dizdaroglu, (2022), for supporting disaster resilience, urban parks should be designed to serve a variety of functions in consideration of emergencies. Thus, at the international level, various initiatives are being implemented by different urban actors, using different tools and strategies for risk prevention and protection, considering OPS as an integral part and essential parameter of their strategies for consolidating urban resilience. There are many examples of how OPS have been used in the context of disasters in many cities around the world.

After the 8.1 magnitude earthquake in Mexico in 1985, public space played an extremely important role not only in the emergency phase, but also in the reconstruction phase, giving it multiple uses. Thus, OPS served as temporary shelters and camps, but also as strategic points for collecting food and supplies, also to provide care and treatment of the injured, and the organization for the work of reconstruction and rebuilding.

According to the study of Montejano-Castillo & Moreno-Villanueva, (2016) eight types of open spaces were used after this disaster; Streets / Avenues / Esplanades / Plazas / Railroad tracks (railways)/ Roundabouts / Sports fields / Transit station. The study also revealed that public squares (plazas) offered the greatest potential for shelter, medical aid base, communication and food preparation and post-disaster organization, while the street network was important for temporary encampments and coordination of relief efforts.

Moreover, to make a city resilient, it should be focus on preparedness for future hazards (Zhao et al., 2017), In Japan, after the 1995 Kobe earthquake, the community sought to address the lessons of the earthquake and experiment in the way they might shape their public spaces. Bryant & Allan, (2013) demonstrated the rehabilitation of open spaces to improve the quality of life in a traditional neighborhood and ensure the safety of its residents. The communities also rehabilitated alleys with safety signs and developed several parks, especially pocket parks as a redundant network. Each park is uniquely designed and is equipped with a water pump, a seat, a flat area, and trees planted for shelter. Therefore, Japan had to revise its emergency response policy focusing mainly on the importance of OPS which suffer little damage from collapse during an earthquake, making them attractive to people and allowing them to become evacuation destinations. The strategy adopted is based on the creation of Disaster Prevention Parks which will be used for shelters, evacuation of the injured, distribution of food and supplies, storages of essential goods needed and emergency supplies. These parks are planned and redeveloped to mitigate risks and have some wide evacuation roads with firebreaks, planted with trees useful for free mitigation, accessible and equipped with lighted signs.

Thus, according to these examples, OPS (parks, public squares, gardens, roads, etc.) Play a major role in risk management and in the resilience of cities to unexpected events (Elewa, 2019). Its use must adapt quickly and efficiently to the exceptional needs of major risk situations and their multiple temporalities. While offering uses adapted to both the pre-disaster and post-disaster periods as a place of welcome and gathering (Shirleyana & Djalante, 2017). In the same context, Pizzo et al., (2014) have also highlighted the importance of open spaces as a first place where people can take refuge, where first aid can be distributed and where people can stay together. This concept of integrating public spaces into risk prevention and management is designed to enhance the effectiveness of the strategies put in place, with the aim of improving the quality of interventions in risk situations. In this way, local authorities and stakeholders will be better prepared for future crisis situations.

The findings of the analysis of international case studies show a planning of OPS that increasingly integrates the consideration of major risks, mainly earthquake-related.

The results revealed the presence of OPS that can adapt to risks, help to reduce negative impacts and promote a sense of safety and well-being in a number of ways. The analyses have also clarified the fact that open public spaces behave in an adaptive and flexible way as a resilient barrier both during and after a major hazard, representing sustainable spaces that perform multiple preventive and safety functions depending on their typologies (punctual and linear) and respond to different uses that facilitate post-disaster management and reconstruction, as we can see in the following table.

OPS	Type of space OPSt	Nature of use OPSu	Function and role OPSf	Localization OPSI
Punctual	-Public square/ Plaza -Garden -Roundabout -Play and sport area -Outdoor parking	Reception and gathering places	-Medical and psychological help -Emergency shelters -Collecting food and supplies -Orientation and communication -Organization after disaster	-Proximity of the neighborhood -Rapid access to emergency facilities -Located in a safe space out of danger
Linear	-Streets -Avenues -Walkways	Linkage and connectivity axis	-Evacuation and transporting of the injured to emergency services -Moving and circulating to other necessary points and structures -Organization of search and rescue activities -Firebreaks that connect densely populated areas to open shelter and secure areas	-In close proximity to the homes of the victims -Large and wide dimensions, especially avenues with center dividers

Table 1. Functional and spatial adaptability of public open space typologies during disasters.

Literary research strategies reveal that public open spaces play an important role in risk management through their functional and spatial adaptability before, during and after a disaster.

This adaptability is characterized by a typological classification of public spaces, their functions and roles, the nature of their uses and, finally, their location in the city.

This plurality of uses in response to major hazards irrevocably transforms the design process for public spaces, calling for a combination of three parameters: multiplication of use, temporality and adaptability.

3.1. Case study of municipality of Ouled Yaich / city of Blida / Algeria

Our study was conducted in the city of Blida which is located in the north of Algeria bordering the capital Algiers. With an area of 19.33 square Km², Ouled Yaich is the most densely populated municipality with more than 200.000 inhabitants.

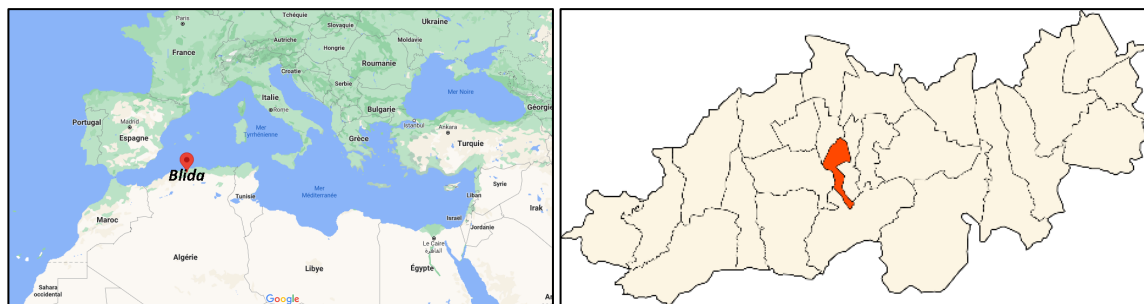


Figure 2. The location of municipality of Ouled Yaich in Blida.

Due to the passage of the Blida fault, this city is classified as seismic zone 3 (high seismicity). This makes the commune of Ouled Yaich vulnerable to earthquakes which may affect the safety of its inhabitants.

Through the study of the Algerian ORSEC plan applied to the municipality of Ouled Yaich in Blida city's, we were able to identify the different structures and spaces that were proposed to be used in the event of a disaster for distribution of local resources, sheltering and protection of victims in these city.

The analysis reveal that they have two types of structures Built and Unbuilt structure.

- The built structures are represented by 43schools, 2 hotels, 3 university campus, 1CFPA (professional training center).
- The unbuilt structures (open structures) are only represented by 1 Communal stadium.

From a global point of view, we can conclude and deduce that the adopted emergency plan (ORSEC Plan) gives priority to built structures, ignoring the use of OPS. This approach is totally incoherent and will lead to the failure of these strategies in the event of a major disaster that destroys or seriously damages built structures.

In this regard, the major failures and gaps in the ORSEC plan for the use of OPS during disaster are as follows:

1. The structures recommended in situation of major risk are mainly built structures, for example, school, hotels ... etc. On the other hand, as far as non-built structures are concerned, it is mainly the soccer fields (stadium) that are proposed.
2. The use of OPS such as squares, gardens, etc. is only proposed in case of collapse of built structures.
3. The ORSEC plan provides for the establishment of temporary relocation camps in the event of a disaster but doesn't identify in any case the location of these camps.
4. The ORSEC plan doesn't propose any emergency operation plan which connects between punctual public open spaces, linear public spaces and emergency structures (hospital, civil protection...etc.) for fast and efficient intervention.

As conclusion, the risk mitigation and the risk management system in Algeria which is based on the activation of the ORSEC plan doesn't take account and consider the use and integration of OPS as a disaster resilience strategy.

To collect more information and data about the integration of OPS during disaster, we used another method which include user satisfaction survey through a questionnaire for the population of the city of Blida. The analyses revealed the importance of OPS during a risk to get to shelter and protect themselves from danger. However, the interviewees, who still have in their mind the situation of Covid 19, expressed different reservations regarding the use of public spaces in times of crisis, such as:

- The lack of OPS adapted to the risk
- The lacking of resources and adapted equipment to deal with the emergency situation in these spaces
- Lack and absence of orientation, communication and management services
- The dissatisfaction with the quality and the role that the OPS played during disaster.

The results of our survey revealed that OPS are highly frequented and used during disasters for safety reasons. However, citizens and users also find that these spaces are underutilized and don't play their real mitigating role in contributing to the urban resilience.

3.2. Indicators of adaptability of the use of OPS

As we have seen, an adaptable linear and punctual OPS play an important role in risk management to unexpected events such as natural disasters. Therefore, the integration of these spaces in the prevention and management plan of emergency aims to increase the effectiveness of the existing strategies and improve the quality of interventions in order to strengthen urban resilience.

The functional and spatial adaptability of the use of OPS, which adapts to the conditions of major risk situations and their different temporalities, depends on their strategic identification, based on a conceptual process represented by selection indicators that must be acquired for their integration in the emergency plans in complementarity with the ORSEC plan.

This research proposes recommendations and guidelines for improving the responsiveness and the adaptability of open public spaces. It reveals the priority selection indicators that need to be taken into account for the achievement of the adaptability of use of OPS, as shown in the following table.

N°	Indicators	Characteristics
01	Connectivity	The OPS must be connected between the different emergency structures and evacuation roads. This allows us to calculate the service radius and the distribution of the surrounding emergency and aid resources (hospital, police, civil protection)
02	Dimension	The dimension of the OPS depends on the service radius and the assigned function. This indicator allows to estimate the capacity of each public space to receive the disaster population
03	Function / flexibility	The function of OPS depends on the size, location and use of the space (large space for emergency facilities and shelters, medium space for population gathering, main road for evacuation...)
04	Location/ Proximity	This indicator allows the allocation and spatial distribution of public open spaces adaptable to the surroundings of the neighborhood
05	Multifunctionality	Installation of water and electricity provision (solar panels) in the park and park road, to avoid interruption of supply.

06	Redundancy of the road network	It provides alternative connections and intersections that increase the resilience of the city.
07	Accessibility / Visibility	The space must be accessible and visible to all to facilitate its location
08	Scale	The network must function according to a hierarchy of scales: commune, wilaya, region.
09	Vegetation/ greenery	Tree planting to be used as a firewalls in case of fire breaking out
10	Security	OPS must be secure and far from any kind of risk so that people can meet, stay together and help each other.

Table 2. Indicators and characteristics of adaptable public open spaces.

The findings of this research consolidate the relationship between OPS, risk prevention and management to achieve urban resilience. Thus, these main indicators contribute effectively to reshaping public space to be both flexible and adaptable in the face of major risks, while at the same time ensuring its integration into a permeable emergency network for urban resilience

In this sense, it's rational to consider OPS as an asset for achieving urban resilience. In other terms, OPS through their crucial role can be considered as an urban tool which must be used and integrated in urban spatial intervention that contributes to urban resilience during disaster.

4. Conclusions

In conclusion, the growing vulnerability of Algeria's territories means that decision makers need to be genuinely aware of the strategic role of OPS as a key parameter of risk management.

To this end, their conceptual, functional and organizational adaptability in the context of major risk prevention and management is essential. This adaptability is achieved through:

- Their identification and strategic classification
- The introduction of new design process adapted to new needs (connectivity, flexibility, urban furniture, dimension, visibility, etc.) and multi-temporalities (times of rest and times of crisis)
- The production of reactionary OPS plan, and
- The integration of reactional OPS plan into the overall risk management plan (ORSEC plan)

In the end, achieving urban resilience in Algeria cities calls for the strategic evolution of planning and risk management tools (ORSEC plan). The conceptual and functional adaptability of OPS before, during and after the disaster is a crucial resource for achieving these objectives.

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Conflict of Interests

The authors declare no conflict of interest.

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