

Proposition of a Smart Resilience Plan: A Case Study of Algiers, North-Africa

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Abstract. Urban resilience is the capacity of a city and its sub-systems to reduce impacts from disturbances, to absorb damages. There are a lot of damages that marked the city of Algiers over the last decade. Consequently, it is essential to account for risks when drafting and implementing spatial plans. This study aims at proposing a smart resilience plan adapted to Algiers. The present study emphasizes the significance of constructing resilience to urban catastrophes in order to minimize the negative effects of disasters and serve as a base for sustainable development.

Key words: urban resilience, hazard, risk, Algeria, Algiers.

1. Introduction

Urban resilience is defined as the capacity of a city and its social, economic, natural, human, technical, and physical sub-systems to absorb damage, reduce impacts (i.e., changes, tensions, destruction, or uncertainty) from disturbances (e.g., shock, natural disaster, changing weather, disasters, crises or disruptive events), and adapt to changes in systems that limit its current or future adaptive capacity¹. Generally, urban resilience and digital platforms are two new research topics. There are not many studies that combine these two elements². However, existing literature suggests that digital platforms could support urban resilience development based on five dimensions: natural, economic, social, infrastructural and institutional³.

The city of Algiers hosts Algeria's main state institutions, and many of the country's most important businesses, organizations, infrastructure, and equipment. If the rate of growth of Algerian economic activity is combined with a very young population today, around 30% is under 14 years old⁴, Algiers could assume a future central role as precursor to a new sustainable dynamic. As Algeria's main political and economic hub, Algiers will strengthen its industrial and tertiary base⁵. After the disasters that have marked Algiers in recent years (such

¹ Ribeiro, P.J.G, Gonçalves, L.A.P.J. (2019), "Urban resilience: A conceptual framework", *Sustainable Cities and Society* 50, 101625.

² Zhang, M., Wu, Q., Li, W., Sun, D., Huang, F. (2021), "Intensifier of urban economic resilience: Specialized or diversified agglomeration?", *PLOS ONE* 16(11), e0260214.

³ Xu, H., Li, Y., Tan, Y., Deng, N. (2021), "A Scientometric Review of Urban Disaster Resilience Research", *International Journal of Environmental Research and Public Health*, 18(7), 3677.

⁴ Aouissi, H. A, Petrișor, A.-I., Ababsa, M., Boștenaru-Dan, M., Tourki, M., Bouzlama, Z. "Influence of Land Use on Avian Diversity in North African Urban Environments", *Land*, 10(4), 2021, 434.

⁵ Kebaili, F.K., Baziz-Berkani, A., Aouissi, H.A., Mihai, F.-C., Houda, M., Ababsa, M., Azab, M., Petrișor, A.-I., Fürst, C. (2022), "Characterization and Planning of Household Waste Management: A Case Study from the MENA Region", *Sustainability*, 14(9), 5461.

as floods in the Bab el Oued commune in 2001, an earthquake in 2003, and a road collapse Ben Aknoun in 2016), it is essential to account for risks when drafting and implementing spatial plans. Two types of risk must be taken into consideration for all urban development operations, i.e., natural and technological risks, the latest generated by industrial activities⁶.

Thus, the planning process requires promoting the participation of all actors (public, private, and citizens) in decision-making⁷, either directly or through legitimate intermediary institutions representing their interests, while integrating the concept of digitalization for optimizing risk management and produce an intelligent resilience plan. At the same time, institutions must adapt to citizens' needs and adopt high-quality criteria for implementing the resilience plan. Institutions need efficient procedures, including management, while making better use of resources⁸. Coordination between different measures must be ensured in a coherent and integrated way⁹. There is a need for broad consensus on policies and procedures while promoting fairness for everyone. Transparency and accountability are fundamental principles of government, private sector, and civil society organizations.

This study aims at answering the following questions: (1) What are the dimensions of urban resilience? (2) What role do digital platforms play for each dimension of urban resilience? (3) Who are the different actors involved in the implementation of an intelligent resilience plan?

2. Methods

2.1. Study Area

The "wilaya" (administrative division) of Algiers is situated at 36°46'34''N, 3°03'36''E in the north. It is located in a geostrategic area. Its boundaries, which are the Mediterranean Sea to the north, the wilayas of Blida, Tipaza, and Boumerdès to the south and east, total more than 808.89 km². There are a total of fifty-seven communes in the wilaya of Algiers, which is made up of thirteen da'ras (administrative districts) and multiple "communes" (municipalities) in each. The 57 communes that make up the wilaya of Algiers are the subject of the study (Fig. 1).

2.2. Intelligent resilience plan

The lack of action plans justifies the need to develop and use a smart resilience plan based on a digital platform, allowing all public and private means to be put into action quickly and

⁶ Bougrine, A. Yelles-Chaouche, A.K. Calais, E. (2019), "Active deformation in Algeria from continuous GPS measurements", *Geophysical Journal International*, 217(1), 572–88.

⁷ Hamma, W., Petrișor, A.-I. (2018), "Urbanization and risks: case of Bejaia city in Algeria", *Human Geographies*, 12, 97–114; Fantazi, I., Hecham, B.Z., Petrișor, A.-I. (2019), "The impact of the absence of the communication on the success of the rehabilitation projects of the built heritage: The case of the old city of Constantine", *Present Environment and Sustainable Development*, 13, 225–39.

⁸ Kupriyanova, V., Estermann, T., Sabic, N. (2018), "Efficiency of Universities: Drivers, Enablers and Limitations", In: Curaj, A., Deca, L., Pricopie, R. (eds), *European Higher Education Area: The Impact of Past and Future Policies*, Springer, Cham, Switzerland.

⁹ Moskolai Ngossaha, J., Houé Ngouna, R., Archimède, B., Pătrașcu, R., Petrișor, A.-I., Fouda, N.M. (2020), "Methodological framework for defining the sustainability management process for urban mobility systems based on a system engineering", *International Journal of Digital Innovation in the Built Environment*, 9, 1–21.

rationally. The plan is applicable to any type of risk and can be triggered partially or wholly, depending on the scale of a disaster. Therefore, it is a form of organized reaction by all means to an exceptional situation.

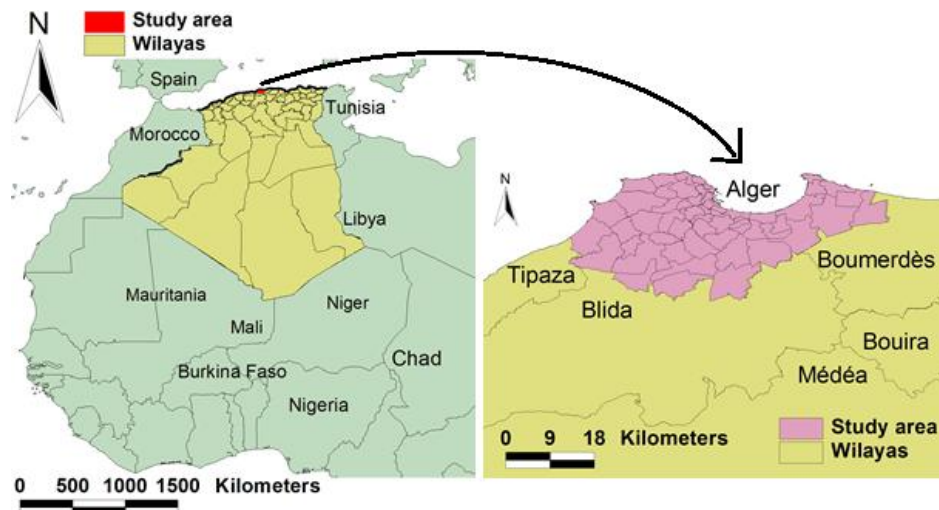


Fig. 1. Location of the case study, adapted from Kebaili *et al.*¹⁰

3. Results and Discussions

3.1. Smart Resilience Plan sectors and sub-sectors

The smart urban resilience plan consists of a set of technical and physical organizational measures identified in advance in this study, including human and physical assets that must be addressed in the event of a disaster. The plan is organized in sectors and each sector in sub-sectors (Fig. 2).

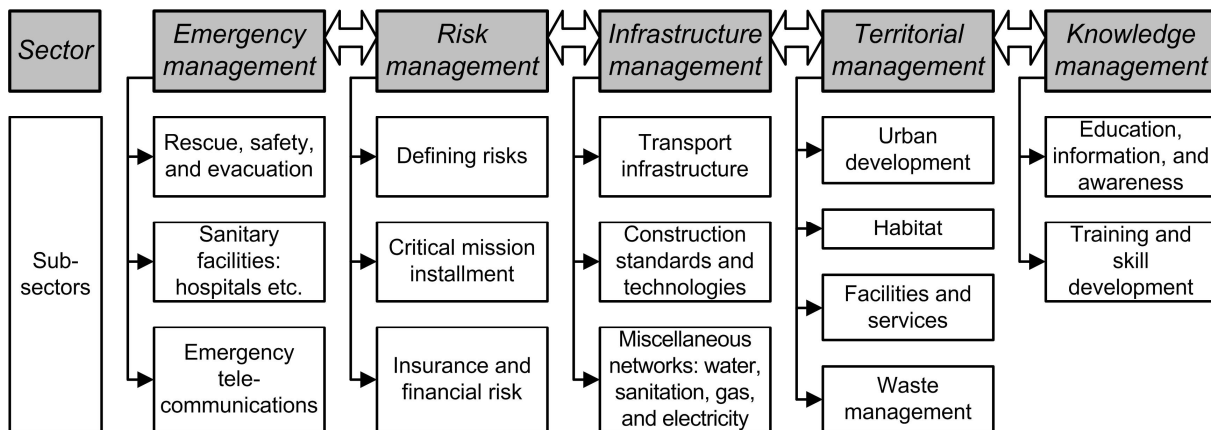
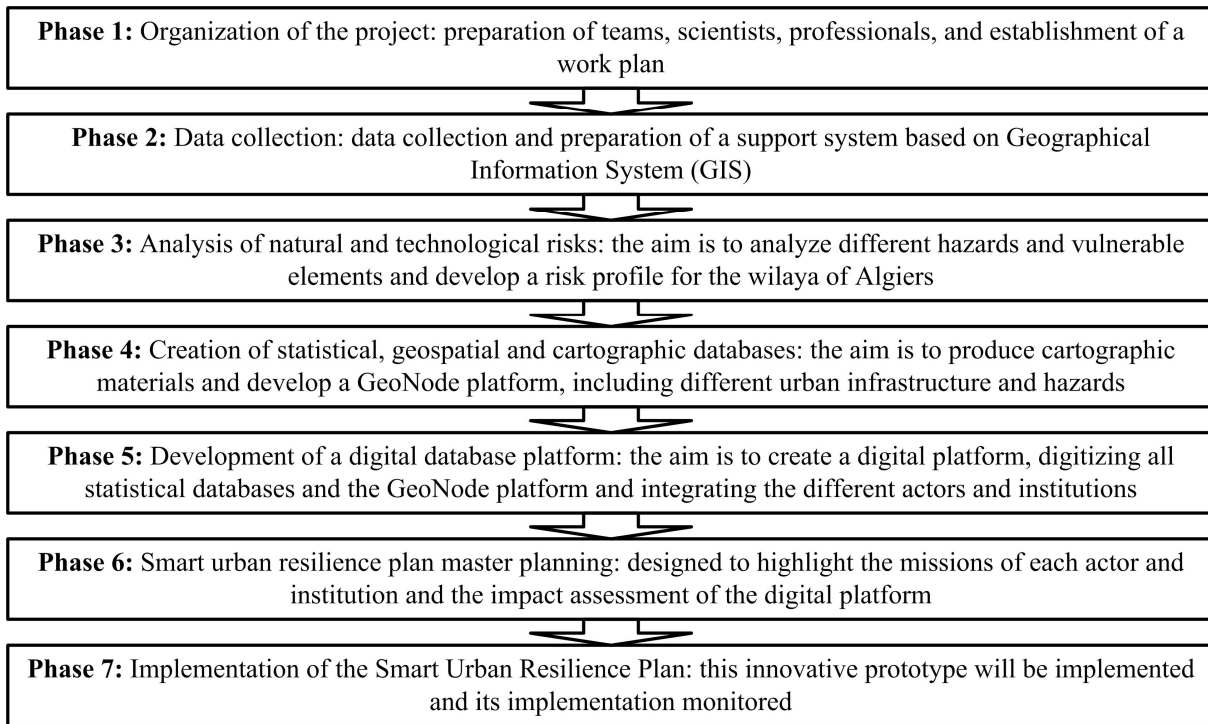


Fig. 2. Schematics of the proposed Smart Resilience Plan for Algiers.

3.2. The production phases

In order to ensure the implementation and enforcement of the proposed plan, it is necessary to organize the work in the phases presented in Fig. 3.

¹⁰ Kebaili, F.K., Baziz-Berkani, A., Aouissi, H.A., Mihai, F.-C., Houda, M., Ababsa, M., Azab, M., Petrișor, A.-I., Fürst, C. (2022), "Characterization and Planning of Household Waste Management: A Case Study from the MENA Region", Sustainability, 14(9), 5461.



3.3. The different actors involved

For implementing the smart resilience plan, the authorities may request staff and means in accordance with the applicable legislation and regulations and the structures presented in Table 1.

Table 1. Sectors and actors involved for a smart resilience plan.

Sectors	Emergency management	Risk Management	Infrastructure Management	Management of territories	Knowledge Management
Actors	<ul style="list-style-type: none"> • Wilaya Security • Commission • Civil Protection Health Directorate • Directorate for Post and Information and Communication Technologies 	<ul style="list-style-type: none"> • Regulatory, General Affairs and Litigation Branch • Accounting and Heritage Budget Directorate 	<ul style="list-style-type: none"> • Transport Directorate • Water Resources Directorate • Directorate for Energy 	<ul style="list-style-type: none"> • Directorate of Public Works • Housing Directorate • Directorate of Town Planning 	<ul style="list-style-type: none"> • Directorate for Social Action and Solidarity

Fig. 3. Phases of the proposed Smart Resilience Plan for Algiers.

1. Emergency management

Stakeholders aim to ensure:

- Ensure security of people and inviolability of property;
- Organize the movement of people and goods;
- Take charge of search, rescue and protection of people and property;
- Support for all health, disease and epidemic prevention operations;
- Provide for the medical evacuation of those injured; - Control the hygiene in the disaster area;
- Promote the emergency facility as a means of connection and transmission; -Restore damaged phone networks.

2. Risk management

Stakeholders aim to:

- Provide the device with various means and equipment;
- Estimate the damage;
- Provide technical advice on specific issues;
- Inform command decisions;
- Propose the measures and resources necessary for the resumption of activities in the area.

3. Infrastructure management

Stakeholders aim to:

- Ensure the supply of drinking water;
- Take charge of any action relating to the hydraulic sector;
- Provide the device with means of transport;
- Restore gas and electricity distribution networks.

4. Territorial management

Concerned actors aim to:

- Provide temporary accommodation for families affected by disaster and for the rehabilitation of buildings affected by disaster;
- Restore basic infrastructure;
- Provide the device with different means of public works.

5. Knowledge management

Concerned actors aim to provide psychological assistance and help to the victims of disaster and their families.

3.4. Intelligent backup plan

Implementing the Intelligent Backup Plan will follow the guidelines set out by the action plan, consisting of three phases (1) emergency plan; (2) evaluation and control; and (3) rehabilitation and/or construction.

1. The emergency phase

The emergency phase consists of assisting the victims of the disaster and implementing actions related to the following missions:

- Rescue and safety;
- Health care;
- Site security and the protection of people and property'
- Food and energy management;
- Possible establishment of a secure hosting site;
- Food and energy supply;
- Crisis communication of a secure hosting site;
- Installation of a logistics base;
- Crisis communication.

2. The evaluation and monitoring phase

The assessment and monitoring phase consists of evaluating and monitoring the actions within the response modules throughout the disaster management process. Evaluation and control shall concern:

- Impact and scale of disaster;
- Response mechanism put in place;
- Operational procedures;
- Communications systems;
- Identification of needs and priorities.

3. The rehabilitation and/or reconstruction phase

This phase consists of ensuring the continuity of operation of essential services, assisting the victims in returning to normal life and facilitating the restart of economic activities.

3.5. Discussion and expected results

Digital platforms can be understood as a socio-technical assembly encompassing technical elements of software and hardware, and associated organizational processes, standards and dynamics¹¹. To succeed, digital platforms must attract a diversity of active players who assume different roles¹². The interaction and/or interdependency among actors is another essential feature of a platform ecosystem¹³. The dynamics of digital platform evolution are influenced by the co-evolution of platform architecture, governance and environment¹⁴.

In addition, digital platforms that work leverage the broader production ecosystem actors with the right skills, appreciating the needs and preferences of consumers to creatively improve the characteristics and attractiveness of digital platforms¹⁵. This process, in turn, improves and supports the interest of consumers in the platform¹⁶. Thus, by relying on the ecosystem of producers, digital platforms can become more innovative¹⁷ than if they had relied on internal resources¹⁸.

¹¹ Tilson, D., Sorensen, C., Lyytinen, K. (2012), "Change and Control Paradoxes in Mobile Infrastructure Innovation: The Android and iOS Mobile Operating Systems Cases", In: Proceedings of the 45th Hawaii International Conference on System Sciences, Maui, HI, USA, 4–7 January 2012, pp. 1324–33.

¹² Darking, M., Whitley, E.A., Dini, P. (2008), "Governing diversity in the digital ecosystem", *Communications of the ACM*, 51, 137–40.

¹³ Jacobides, M.G., Cennamo, C., Gawer, A. (2018), "Towards a Theory of Ecosystems", *Strategic Management Journal*, 39, 2255–76; Spagnoletti, P., Resca, A., Lee, G. (2015), "A Design Theory for Digital Platforms Supporting Online Communities: A Multiple Case Study", *Journal of Information Technology*, 30, 364–80.

¹⁴ Tiwana, A. (2010), "Research Commentary - Platform Evolution: Coevolution of Platform Architecture, Governance, and Environmental Dynamics", *Information Systems Research*, 21, 675–87.

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¹⁷ Adner, R., Kapoor, R. (2010), "Value creation in innovation ecosystems: How the structure of technological interdependence affects firm performance in new technology generations", *Strategic Management Journal*, 31, 306–33.

¹⁸ Parker, G., Van Alstyne, M. (2017), "Innovation, Openness, and Platform Control", *Management Science*, 64, 3015–32.

4. Conclusion

As a result of today's rising urbanization, which increases people's exposure and vulnerability to natural and anthropogenic disasters, cities and their residents face ongoing and significant difficulties. The significance of constructing resilience to urban catastrophes is understood more and more as a way to minimize the negative effects of disasters and serve as a base for sustainable development. Meanwhile, the coordination between different types of industrial agglomerations should be considered. In the end, we recommend to concerned authorities and policy-makers to pay more attention to the specific features of our area.

5. Acknowledgment

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