

The Contribution of the City Planning in the Urban Resilience to the Hazards of Earthquakes and Floods: the Case of Morocco

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Key words : Urban Planning, Urban Resilience, Hazard, Flood, Earthquake, Morocco

SUMMARY

The occurrence of natural disasters and the extent of the resulting damages has led societies throughout the history to set out the conditions of proactive "natural" risk management. Morocco as many countries in the world, has suffered from the devastating consequences of earthquakes and floods. Urban space is particularly vulnerable to these hazards due to the concentration of people and buildings and the expansion of built and impervious areas, which amplifies the effects induced by these causing damage phenomena. The risk management has become an imperative of the public policy; Morocco has invested in the implementation of structural and non-structural measures to deal with, among others, the aforementioned urban risks and to improve urban resilience.

The aim of this research is to show the methods in use to manage the urban hazard, the contribution of urban planning and land use and regulatory provisions in the prevention and resilience to such natural hazards.

RESUME

La fréquence d'occurrence des catastrophes naturelles et l'ampleur des dégâts y afférents, a amené les sociétés tout au long de l'histoire à chercher les moyens et les outils pour se prémunir contre ces risques. Le Maroc comme de nombreux pays dans le monde a subi les conséquences néfastes des séismes et des inondations. L'espace urbain est particulièrement vulnérable à ces aléas par la concentration de la population et des bâtiments et par l'extension des surfaces construites et imperméabilisées, ce qui amplifie les effets induits par ces phénomènes générateurs de dommages. Gérer les risques est devenu un impératif de l'action publique, le Maroc s'est investi dans la mise en œuvre de mesures structurelles et non structurelles pour faire face, entre autres, aux risques urbains précités et pour améliorer la résilience urbaine. Dans cette recherche, on va expliciter les modes de gestion des risques urbains et l'apport de la planification urbaine et de l'aménagement dans la prévention desdits risques naturels et dans la mise en place de mesures adéquates susceptibles d'améliorer la résilience et le rétablissement.

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1. INTRODUCTION

The occurrence of natural disasters in urban areas is certainly a calamitous event because they cause property damage and / or loss of human lives, evidenced by the history of humanity where people were traumatized by devastating disasters (earthquakes, floods, tsunamis, etc.).

These natural disasters are a potential source of major losses for Morocco. Even the leading economies and the most technologically advanced are suffering to cope with these events:

- The earthquake and tsunami in Japan (20,000 deaths, 2011);

- The earthquake in China (80,000 deaths, 2008);

are a significant examples in this regard. Disasters have also had a devastating impact in countries with low and middle incomes: the earthquake in Turkey (19,000 dead, 1999), the tsunami in the Indian Ocean (250,000 deaths, 2004), etc.

Partial summary of major historical disasters in Morocco 1900–2008			
	Deaths	Total population affected	Estimated damage (millions of dirhams)
Floods	1,556	531,926	2,400
Earthquakes	12,728	38,465	4,200
Drought/Heat Wave	—	412,000	7,200
Total	14,531	997,549	13,800

These shocks, which cause human suffering and major social, economic and political upheavals are fundamentally changing the way the governments perceive the importance of good risk management and the need to strengthen national resilience.

Morocco is one of the pioneering countries in the development of an integrated strategy for hazards management. Among the main hazards considered by the government as a priority, natural disasters, because the country is exposed to earthquakes, tsunamis and floods. These risks cost for Morocco, according to the probabilistic assessments, an average of DH 5.0 billion per year, in which floods constitute the major part.

An interministerial project carried out in 2010-12 has addressed the risks of natural disasters in Morocco in coordinated action with the support of the World Bank, the Global Fund for Disaster Reduction and Recovery (GFDRR) and the Swiss Agency for cooperation and development (SDC).

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The project has developed a new analytical tool on GIS MnhPRA ("Morocco natural hazards Probabilistic Risk Analysis" which was used to analyze seismic hazards, floods, tsunamis, droughts and landslides in Morocco using advanced probabilistic assessment of risks (or disasters models).

2. FRAMEWORK AND DISASTER HAZARD MANAGEMENT OPTIONS

2.1 Institutional and legal framework for disaster hazard management

Morocco has a number of institutions managing some aspects of disaster risk. These include, among others, the Ministry of Interior, the Ministry of Water and Environment, the Ministry of Health and the Ministry of Finance.

Within the Interior Ministry was set up a crisis response system supported by a legislative framework:

- a National Coordination Committee to coordinate emergency situations involving the different ministries and technical and scientific committees during the disaster and
- a Watch and Coordination Centre to manage the actual emergency situation on the ground, ensuring the allocation of resources (financial and material) and the stakeholder coordination.

Regarding hazard prevention and preparedness, although some initiatives are implemented, Morocco has a very fragmented approach. For example, from a legal point of view, the Ministry of Environment has the mandate to prevent the risk of natural disasters (Decree No. 2-99-922 set up in 2000) and to manage crises of marine pollution (According to the National Emergency Plan, in effect since 2003), while all other aspects of crisis prevention is the responsibility of the Ministry of the Interior (decree of 1997), which does not encourage a joint work.

Scientific organizations such as the National Institute of Geophysics are conducting research works on seismic activity in Morocco and carrying out a mapping of national areas of seismic hazard to design better building codes. Similarly, various river basin authorities collect data on rainfall and flow of rivers, and develop flood maps. There are specific programs of disaster risk mitigation for protection against floods and preparedness for earthquakes.

The Water Secretariat has developed the National Strategy for Water in 2009, including the establishment of early warning systems for floods, as well as weather forecasts, including flood risk plans for urban planning and management of watersheds. Morocco has also a National Plan for Protection against flooding that identifies specific sites vulnerable to flooding and determines the investment programs. Moreover, following the earthquake in Al Hoceima 2004, Moroccan building codes were updated in 2011 (RPS2011) and now set standards for the calculation and design of structures to strengthen them against the seismic shocks and adopt the technical provisions of civil engineering and architectural design of buildings resistant to earthquakes.

2.2 Options to reduce the natural disasters hazard in Morocco

This should go through the following programs:

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- Early warning systems are required to earthquakes, floods and tsunamis. The tsunami warning is probably the only feasible mitigation of this hazard for Morocco, and should begin with the participation of Morocco in North Eastern Atlantic, the Mediterranean and Connected Seas Tsunami Early Warning and Mitigation System, while developing and deploying a tsunami warning diffusion system that includes public awareness, evacuation signs in case of tsunami and other measures to effectively exploit the technical alert. The warning earthquakes is an emerging technology, but has worked in Mexico and Turkey during the last decade and is becoming operational in Japan and the United States. It could be applied in northern Morocco. Flood warning systems are already implemented in some watersheds in Morocco, and this mitigation approach should be greatly expanded (eg with the purchase of several more modern meteorological stations).
- Mapping and risk analysis for floods and earthquakes should be improved, with priority given to certain new areas of development, including the "new towns". This will also allow Morocco to strengthen its building standards, its activities and priorities in the post-disaster reconstruction. Deeper additional analysis should be performed for high risk areas that have been identified by MnhPRA- namely, Knitra, Tetouane, Casablanca, Sidi Kacem, and Laaraiche for floods and Nador, Al Hoceima, Berkane, Taza and Tetouane for earthquakes.
- The building compliance code should be improved to reduce the impact of potential earthquake in those provinces with high seismic risk.
- The earthquake Compliance of public buildings in the five provinces with high risk of earthquake should be conducted and extended to other provinces in time. Preliminary studies carried out by the World Bank indicate that in those provinces, earthquake reinforcement of essential facilities typically cost about 20% of the replacement value.

In addition to these institutional reforms and structural measures, risk transfer interventions, including in the area of risk financing, are equally important. In recognition of the need for more effective risk financing in Morocco, the Ministry of Economy and Finance has already begun to develop an insurance program of disaster risk for the residential and commercial field.

3. ROLE OF URBAN PLANNING IN RISK MANAGEMENT

Urban planning is crucial in defining the use of the soil and achieving the objectives of civil security and environmental safety. Urban planning prefigures the desired image of the city on planning documents, taken as a reference for future locations of buildings and public spaces, which allows translating the graphics to real and materialized backgrounds.

Preventive responses by the planning regulations aim to limit essentially victims and damage following a hazard by intervening on two factors of vulnerability: the forms and types of land use, nature and quality of construction. This regulation is reflected in the enactment of restrictive standards of parcels constructability that form public utility easements imposing constraints on the handling of any new authorization

3.1 The building regulations: the case of earthquake

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Any builder must respect the rules of art and adapt the structure and fabric to the circumstances according to natural conditions and risks. Seismic regulations implemented in Morocco from 2002 take into account, beside the hazard, the sites effects, likely to intensify their impacts.

The seismicity in Morocco is considered "low to moderate" despite very destructive earthquakes, the Agadir in 1960, of magnitude 5.8. It caused more than 12,000 victims and destroyed 70% of the buildings, causing \$ 290 million in damage.

More recently, the Al Hoceima earthquake, which occurred in February 2004, showed that in urban areas, only unrealized constructions according to the rules of art have not resisted to the tremors. Mediocrity and fragility of traditional buildings in rural areas have caused enormous human and material losses. The damage was very heavy in terms of reconstruction costs for the province of Al Hoceima.

We cannot avoid exposure to earthquake risk, but we must try to anticipate it and prepare for it. Thus, in each earthquake, seismic regulation is enriched and modified. The latter, based on earthquake engineering, assesses the lateral seismic forces to consider in the design of buildings. In Morocco, this regulation is not set up until after 1960: the first earthquake regulations (RPS), which covered only the Agadir region was called "Agadir Standards 1960". Since then, several RPS projects covering the national territory have been drafted, but couldn't be approved for technical or regulatory reasons.

It was only in 2002 that the RPS 2000 establishing the National Earthquake Engineering Committee was made mandatory by the Decree No. 2-02-177 of 22 February 2002. This document sets the rules for calculation and design of structures to strengthen the buildings resistance to earthquakes. It also enacts civil engineering technical requirements and architectural design allowing buildings to withstand all the shaking intensities. It applies to new buildings and buildings undergoing major changes, such as changes in use, transformations for public safety reasons or extension.

The scope of the RPS 2000 cover reinforced concrete and steel structures. it divided Morocco into three homogeneous seismic areas with the same level of risk. The buildings are classified according to their importance, and soils according to their nature. Seven years after its entry into force, the RPS 2000 is under review by the State to facilitate its use by two seismic maps (acceleration and speed of the earthquake), new data, refining the seismic zoning by site, and improving the ranking of constructions.

3.2 Preventive urban planning regulations

The consideration of natural hazards in the land did not appear in Morocco until the end of the 20th century when the authorities were forced, mainly as a floods result, to establish protection easements against potential natural hazards.

These restrictions have faced the reluctance of Communes, because they could be in contradiction with development projects. This is why in the study phase of urban planning documents, the competent authorities are consulted about the risks and related easements to be integrated in the

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planning documents. While the graphics plans may bring up areas where risk determines a zoning in which may be prohibited or subject to special conditions any kind of buildings or installations. It is recalled that these graphics documents are enforceable against third parties and can therefore follow a local policy of risk prevention.

The initial phase is that of gathering the informational documents about foreseeable risks. It is to draw up a complete inventory of these hazards. To do this, it uses the local memories and archives, plus the scientific studies and knowledge of specialized agencies, producers of different informative documents. All this information is mapped into hazard maps and eventually integrated into GIS. On this territory, careful studies of land use are performed to determine the degrees of vulnerabilities relating to people, buildings and equipment.

The resulting zoning shows hazard exposed areas. They must take account of the nature and intensity of the arising risks and for the future, we prohibit there any construction or development. This zoning also demarcate areas that are not directly exposed to the risks but where constructions or development could aggravate or create new ones. There is therefore provided prohibition measures or special requirements

The flood risk is the most represented in Morocco, prevention leads to severely modify certain city planning documents and to significantly reduce the buildable areas. Regarding the seismic hazard, we also wonder about the effects of prevention of this risk on the already urbanized areas and on costs that could result from the compliance with texts concerning the implementation of seismic standards in existing buildings undergoing modifications by change of use or raising the height or extensions. This may result on collective attitudes of strong pressure on services that lead the project of planning documents, with an argumentation that minimizes the hazard and believes that we can adhere to the protection of existing technical works.

BIOGRAPHICAL NOTES

Birth date: 1976 in Taroudannt, Morocco.

*** Diplomas:**

-2010: Master in business law;

-2006: Degree in private law;

-2001: Diploma of Engineer surveyor.

**** Some Presentations:**

- Presentation of the theme « Moroccan Public Policy of the Fight Against Insalubrious Housing » at the FIG Conference, FIG Working Week 2015 “from the wisdom of the ages to the challenges of the modern world”, Sofia, Bulgaria, 17- 21 May 2015;

- Presentation of the theme « The Environment Place in Moroccan Urban Planning» at the XXV FIG Congress “Engaging the Challenges, Enhancing the Relevance”, Kuala Lumpur, Malaysia, 16 – 21 June 2014;

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- Presentation of the theme «City Planning in Morocco: reality and perspectives » at the FIG Conference, FIG Working Week 2011, “Bridging the Gap Between Cultures”, Marrakech, Morocco, 18-22 May 2011

*** Professional experience

2017 : Head of the Department of urban management and legal Affairs at the Berrechid urbanism agency;

2012- 2016 : manager of the Department of legal and land Affairs at the Settata urbanism agency;

2010-2013 : Head of Berrechid urbanism administrative unit and head of the land division; Settata urbanism agency;

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