01

Conceptualizing urban resilience to natural hazards

1.1 Resilience

A fusion of ideas from various fields has been used to underpin certain aspects of resilience. In order to effectively address resilience-building issues, particularly those related to urban resilience to disaster and climate risks, it is important to first have an understanding of the concept of resilience. David E. Alexander (2013) traces the evolution of the concept from Roman antiquity to modern times. The first scientific definition of the concept, due to Holing (1973), emphasized on the general persistence of ecological systems functioning under continuous change. Later it was expanded to address the question of the *adaptation* of humans in nature. The most recent refinement of the concept takes it to the more critical question of social *transformation* in the face of global change, the latter implying that environmental problems cannot be addressed in isolation from the social context and that when exposed to specific shocks a system can undergo transformation from one state to another, creating thereby a new system pathway.

In simple terms resilience is the long-term capacity of a system to deal with change and shocks and continue to evolve. UNISDR defines resilience as "the ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management."[1] This definition emphasizes hazards and the ability to resist and recover quickly.

The Intergovernmental Panel on Climate Change (IPCC 2014b) definition of resilience is similar to that of the UNISDR, except that it also highlights the ability to anticipate hazards as a key element in resilience-building, and to maintain "the capacity for adaptation, learning and transformation."

With the focus on socioecological systems, scholars from the Resilience Alliance (RA 2010) drew attention to further characteristics of resilience (i.e., the capacity of a system for learning, adaptation and self-organization).

In its Strategic Plan 2014-2017: Changing with the World, UNDP defines resilience as "an inherent as well as acquired condition achieved by managing risks over time at individual, household, community, and societal levels in ways that minimize costs, build capacity to manage and sustain development momentum, and maximize transformative potential."[2] Importantly, UNDP places risk at the centre of resilience-building, linking it with sustainable development objectives.

FOOTNOTES

[1] United Nations. *Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction*, 1 December 2016 (A/71/644, p. 22).

[2] UNDP Strategic Plan 2014-2017: Changing with the World, p. 34, note 8. http://www.undp.org/content/dam/undp/library/corporate/UNDP_strategic-plan_14-17_v9_web.pdf. Accessed 25 February 2018.

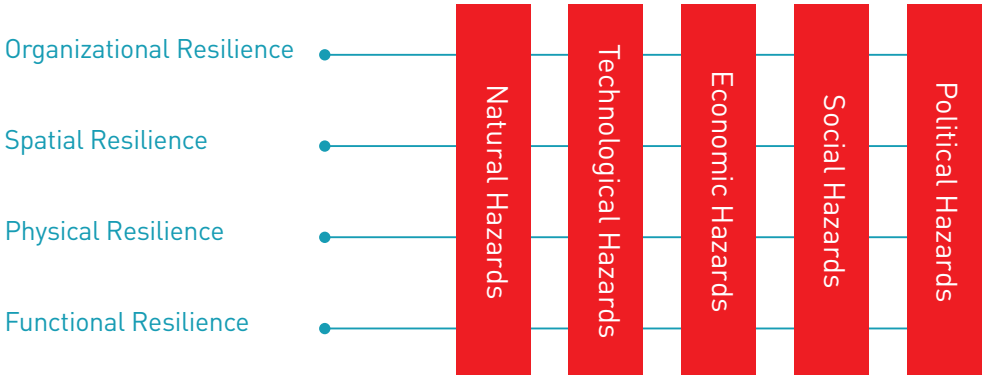
At the core of the concept of resilience is the notion of change (especially in the form of shocks) and its associated risks, often (but not always) a change that could potentially have a negative impact on a system (e.g., disaster, crisis, stress or disturbance). This *Report* employs such an operationalization of the concept of resilience that reflects the latest thinking within the scholars' community,[3] and is geared to address uncertainties and manage risks:

- capacity to anticipate risk
- capacity to respond to and manage risk (including risk reduction and risk transfer)
- capacity to cope with disaster, crisis, stress, disruptions (when risk materializes)
- capacity to recover from disaster, crisis, stress, disruptions
- capacity to adapt to a changing context (by learning)

1.2 Urban resilience

Resilience has emerged as a central theme in urban development, being perceived as a quality of sustainable urban development as much as a driver of development itself.[4] In the run-up to the Habitat III Conference held in October 2016, the UN Task Team on Habitat III proposed a concept for urban resilience: the Urban System Model Approach. The model highlights a variety of hazards and, importantly, pinpoints the urban systems whose resilience is crucial to build and maintain the effective functioning of cities. Figure 1 illustrates the Urban System Model Approach.

Figure 1
Urban system model approach



The model considers four critical and interdependent dimensions of urban resilience common to all human settlements: organizational, spatial, physical and functional. *Organizational resilience* implies resilience of any human association – formal or informal, corporate or political, at various scales. The *spatial resilience* highlights the difference in spatial distribution of human settlements from the smallest plot up through urban segments, to peri-urban, district, national and international contexts. The *physical resilience* refers to the resilience of infrastructure from small dwellings to the complex, built environment of megacities. Finally, *functional resilience* reflects the importance of processes and flows from a rural village market and transport hub, to commercial, governance, and social processes in large cities.

While this model addresses all possible hazards (e.g., natural, technological, social, economic, political), the focus of this *Report* will be on natural hazards only and the resilience of Arab cities against the risks posed by those hazards.

FOOTNOTES

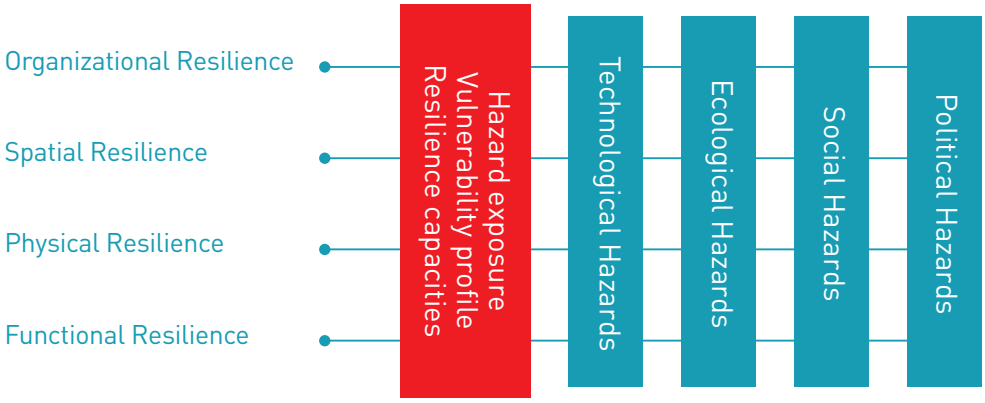
[3] Birkmann et al. 2013.

[4] UN-Habitat 2015c.

1.3 Urban resilience to natural hazards

When addressing urban resilience to natural hazards it is important to understand the scenarios of disaster and climate risks that could possibly threaten the well-being of the urban population and the proper functioning of the urban system. The risks to urban systems originate from a complex interplay of hazards, exposure and vulnerabilities in the urban setting, in combination with the effectiveness of the resilience capacities in place.

Figure 2
Urban system model: drivers and challenges to resilience



1.4 Some background considerations

Before turning to an analysis of the urban resilience of Arab cities, it is important to reflect upon the following aspects that help to explain the gravity of the challenge and provide direction for resilience analyses.

1.4.1 Disaster risks are socially constructed

Since 1990, academics and practitioners around the globe have increasingly come to recognize the notion that disaster risk is a social construct.[5] The social nature of disaster risks can be explained by two factors: (a) vulnerability that has a social quality (the vulnerability of the poor population in slums differs from that of the middle-income population in a metropolitan area, for example); and (b) the perception of risk that can be explained by the level of understanding about the actual exposure to hazards and the potential consequences. Regarding the latter, there is a growing gap between expert and lay people's assessments of risk that can have adverse consequences in terms of acceptance of disaster risk management (DRM) measures, trust in institutions introducing DRM measures, and the general level of preparedness of the population to cope with risks. Therefore, when assessing disaster and climate risks and defining resilience-building strategies, it is essential to take the socially constructed nature of risk into consideration.

FOOTNOTES
[5] Birkmann et al. 2013.

1.4.2 Understanding emerging disaster and climate risks is increasingly difficult

In its review *Future Global Shocks* (OECD 2011), the Organisation for Economic Co-operation and Development emphasized that in the future, the task of assessing risk will be made all the more difficult by the interaction of known risks with previously unknown or unprepared-for vulnerabilities. While this argument is made in regard to global shocks and novel hazards, it equally applies when addressing risks from natural hazards, because it is difficult to ascertain, due to ever-growing interdependencies, the distributional effects of disaster and climate risks across geographic regions, sectors, industries and generations. This makes it necessary to take into account not only the known risks, but also the unknown ones. This challenges the capacity of the relevant agencies to anticipate, plan and respond to emerging risks and, most importantly, how their effects could cascade across various systems. Therefore, resilience-building strategies should be focused not only on adaptation to or reduction of predictable risks, but also on creating the necessary conditions for pre-adaptation, also called *exaptation* (a generic trait gets used for something else, unexpectedly by surprise).[6]

This requires building certain qualities into a resilient system. In its City Resilience Index, for example, the Rockefeller Foundation explores various indicators of a resilient system, among which are redundancy, or the spare capacity of a system to be able to accommodate a disaster, and flexibility – when a system can evolve and adapt in response to a change, which in turn would imply a degree of decentralization in the system.

1.4.3 Emerging vulnerabilities require regular relevance checks

One of the confident conclusions of the IPCC landmark publication, *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation,* is that *"vulnerability and exposure are dynamic, varying across temporal and spatial scales, and depend on economic, social, geographic, demographic, cultural, institutional, governance, and environmental factors."*[7] The relevance of this statement can be further emphasized from the resilience perspective. Aggravation of vulnerability will inevitably change (lower) the threshold[8] of the system's susceptibility to the severity of a natural hazard. That is why many would argue that reducing vulnerabilities and improving livelihoods could be considered a means to improve resilience.[9] A changing vulnerability context explains the emerging or re-emerging nature of disaster or climate risks. Therefore, when setting up resilience indicators and standards for resilience-building, it is also important to carry out regular relevance checks (in light of the changed hazard and vulnerability profile) of the resilience threshold, and thus the targets for resilience-building.

FOOTNOTES

[6] Dave Snowden, Cognitive Edge, http://cognitive-edge.com. See also his public lecture at the Ohio State Wexner Medical Center [https://www.youtube.com/watch?v=pHjeFFGug1Y]. Accessed 25 February 2018.

[7] IPCC 2012, p. 67.

[8] Climate threshold: "A critical limit within the climate system that induces a non-linear response to a given forcing." See also Abrupt climate change (Ibid, p. 557).

[9] IDS 1992.

1.4.4 Resilience-building has to be sufficiently future-oriented

In addressing resilience, it should be recognized that resilience-building requires a time horizon well beyond today. There is no need to build resilience to today's risks if they are likely to change significantly in the future. Defining which time horizon in the future to target could potentially explain the pace of resilience-building, standards and indicators, and type of planning required, as well as the outcomes of the resilience-building effort. Therefore, when designing and implementing resilience programs, the time horizon identified by different stakeholders for resilience-building across various dimensions of the urban system needs to be carefully considered.

1.4.5 Resilience-building requires trade-offs

Resilience-building is a political decision. It often has trade-offs that require some amount of risk to be tolerated in one or more areas, for one or another stakeholder. In a resource-constrained context, there will always be trade-offs between what is practical, what is fair, what is affordable, etc. Ultimately, addressing resilience requires careful consideration about which risks matter and therefore, which risks to prioritize and which to tolerate. In building resilience there will be winners and losers. Therefore, resilience-building inevitably is intertwined with issues of equality in society. This is relevant even when comparing risks across the same time horizon or those that target a different time horizon. Trade-offs in making decisions about resilience investments has to be driven by ethical and practical considerations, which closely relates to the following statement.

1.4.6 Resilience is not necessarily good or bad

Investment in resilience-building has to be justified. It might very well be the case that instead of investing in building resilience it may be more prudent to allow the system to cross the threshold. For example, it may not be justified to invest in building resilient housing in coastal areas that will be subject to significant inundation over a period of ten years due to the changing climate. Instead, the best option might be to relocate the settlement to other areas. Therefore, the focus is not on resilience *per se* but on a tailored response to the risks that populations, ecosystems and infrastructures are facing in a given time frame. Again, the question is: Whose risks set the priorities when addressing disasters and climate change?

1.4.7 Resilience of critical infrastructure with supranational significance raises global risk governance issues

When building urban resilience to natural disasters and climate risks it is also important to acknowledge that large cities often host critical infrastructure (CI) with a regional or even global significance. The disruption of properly functioning CIs by disasters could have potential ramifications impacting sectors and territorial jurisdictions, extending far beyond the city itself. Such risks raise numerous questions concerning global risk governance.

1.4.8 Domino effect of risk impact in cities[10]

The unique dynamics of risk in urban settings rest in the intricate links between cities and disasters that evolve in two directions: disaster causes the destruction of the built environment, while at the same time, the inherent organizational, spatial, physical and institutional nature of the urban fabric in itself increases the risk: intensifying hazards or creating new ones, exacerbating vulnerabilities, and negatively affecting existing response and recovery mechanisms. The city-disasters nexus needs to be explored from this reciprocal perspective, recognizing that risk can travel across sectors, industries, geographic locations, generations, etc.

1.4.9 Disrupted cause and effect relationships of risk

Such disruption occurs in various dimensions: across generations, geographic borders, jurisdictions, sectors and institutions – a butterfly effect that often escapes our attention. For instance, the factors generating and amplifying risk might be contributed to by one group of actors, whereas the effects of the risk can be significant for another group. Risks we cause today may have an impact over generations (think of climate change, for instance). This requires a more holistic approach in understanding and responding to disaster and climate risks. Resilience-building, therefore, is inevitably linked with the multiplicity and interconnectedness of various risks across different domains that could potentially be triggered or exacerbated by a disaster or climate risks.

FOOTNOTES

[10] This paragraph is indebted to C. Wamsler and E. Brink, "The Urban Domino Effect: A Conceptualization of Cities' Interconnectedness of Risk." Input paper for the *Global Assessment Report on Disaster Risk Reduction* (GAR) 2015. Available at https://www.unisdr.org/we/inform/publications/48146.

1.5 Resilience-building indicators and targets

The selection of indicators depends on the assumption of what is being measured or assessed: Is resilience a process or is it an outcome? To be able to measure resilience, it is important to address the following questions: The resilience of what? To what? For whom? For what purpose?

It is difficult to recognize resilience in action. Some would argue that resilience cannot be measured, but only illustrated in perspective (e.g., more resilient than before or more resilient than others). However, there is growing consensus that "measuring resilience provides a potentially powerful way to evaluate both intentional change, as in the change that results from programmes or policies, and unintentional change that comes about as a result of unforeseen system dynamics."[11]

Resilience indicators are often designed to address the goal of positive livelihood outcomes rather than resilience *per se*.[12] Thus, from this perspective, resilience can be measured with development indicators. The OECD (2014), for instance, defines various levels and types of indicators including process, output, and proxy impact indicators. In the meantime, according to ODI (2015) findings, a resilient system has certain qualities that define the key set of criteria for resilience indicators: *learning, options* and *flexibility*. Learning implies a better understanding of the hazards and vulnerabilities, awareness of risks, and an ability to incorporate lessons learned into resilience strategies and programmes. The options, or diversity, criterion implies access to a variety of means to cope with risks and circumvent the drivers of vulnerability. Flexibility implies that systems can perform and deliver their services under a wide range of conditions, including disasters.

While there have been many attempts to conceptualize resilience measurement and its indicators, there is a practical need to measure resilience using consistent mechanisms, in order to enhance accountability, guide public investment and define the road map for improvement. With regard to measuring urban resilience, there are six signficant developments taking place today:

- UN-Habitat is currently developing a set of indicators to support the implementation of the Urban System Model Approach. This is a work in progress.
- The World Bank Global Facility for Disaster Reduction and Recovery (GFDRR)[13] have developed the CityStrength Diagnostic tool for risk, resilience, and the performance of urban systems. The tool is structured around sectoral modules, including community and social protection, DRM, education, energy, environment, health, water, sanitation, etc.
- The Rockefeller Foundation, together with Arup, has developed the City Resilience Framework[14] that explores the qualities of resilient systems, indicators and categories. Importantly, the focus of this work is on city resilience in all categories, including health and well-being, the economy and society, infrastructure and environment, as well as leadership and strategy.

FOOTNOTES

[11] Quinlan et al. 2015, p. 9 (685).

[12] ODI 2015.

[13] http://www.worldbank.org/en/topic/urbandevelopment/brief/citystrength.

[14] http://www.100resilientcities.org/resilience#/-_/.

- The OECD is also investigating how cities can increase their resilience through governance, environment, economy and society.[15]
- The Resilient City Connect (RCC)[16] platform has been established as a partnership between UNISDR, the Netherlands' Ministry of Infrastructure and Environment, and the Japan Bosai Platform (JBP), a business association representing 119 small to large corporations based in Japan. The RCC platform is deemed a learning place for cities to know more, to invest wisely and to build more safely. It has become the world's largest association of local governments, with more than 3,000 cities and municipalities signed up to the partnership.
- UNISDR's Making Cities Resilient Campaign[17] focuses solely on building the resilience of cities to natural disasters and climate risks disasters. UNISDR has developed and effectively implemented around the globe the 'Ten Essentials' for city municipalities to comply with in order to make them resilient to disasters. About 3,000 cities had joined the campaign by 2015. From 2017 onward, an updated version of the Ten Essentials is being piloted. The handbook for mayors, governors, councillors and other local government leaders on "How to Make Cities More Resilient" was translated into Arabic and has been widely disseminated in the region. UNISDR provided a self-monitoring tool to all participating cities; the Local Government Self-Assessment Tool (LGSAT) assists local governments to assess DRR progress, and aids them in addressing gaps and challenges.

UNISDR has also committed to support the implementation of the standardized performance measurement of sustainable cities. To measure this, 100 indicators have been defined and included in ISO 37120:2014,[18] developed by the Global City Indicators Facility (GCIF)[19] and coordinated by the World Council on City Data (WCCD).[20]

To address some of the divergence in tools and approaches to building urban resilience, a new alliance among nine of the world's largest UN and non-UN organizations,[21] called Medellín Collaboration for Urban Resilience,[22] was established at the World Urban Forum in 2014. Its purpose is to foster the harmonization of approaches and tools used in different contexts for assessing strengths and vulnerabilities to natural hazards.

It is important to recognize another aspect of resilience measurement, which is that measuring resilience numerically is impractical. Resilience cannot be measured as a single entity due to the different risks facing people and the varying abilities they may rely on to address those risks.[23]

FOOTNOTES

[15] http://www.100resilientcities.org/resilience#/-_/.

[16] https://www.unisdr.org/archive/43216.

[17] https://www.unisdr.org/we/campaign/cities and https://www.unisdr.org/campaign/resilientcities/.

[18] http://www.iso.org/iso/37120_briefing_note.pdf.

[19] http://cityindicators.org.

[20] http://www.dataforcities.org/wccd/.

[21] The Collaboration includes: UN Office for Disaster Risk Reduction (UNISDR), UN-Habitat, the Rockefeller Foundation's 100 Resilient Cities Acceleration Initiative and C40 Cities Climate Leadership Group, the World Bank, the Global Facility for Disaster Reduction and Recovery (GFDRR), ICLEI – Local Governments for Sustainability, and the Inter-American Development Bank.

[22] http://unhabitat.org/new-global-collaboration-for-urban-resilience-announced-at-wuf7/.

[23] ODI 2014.