

AN INTRODUCTION OF URBAN DESIGN AS A TOOL FOR DISASTER RESILIENCE

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ABSTRACT

Importance of resilience is more and more felt in various aspects of built environment in the ever changing, unpredictable complex world. The concept of resilience is now the new catch word brought up as part of the vision statements in many cases in local, national and international levels to present solutions for the world's complex problems, in this case, urban areas. This concept has started a long journey from various disciplines, and its use is spreading through many disciplines as its capacity to deal with complex and unpredictable issue is becoming more tangible. The aim of this article is to introduce the concept of urban resilience in the field of urban design that is still unclear on the level of general goal setting statements even in the international ongoing campaigns. We need to extract attributes of urban resilience from resilience studies that usually come from other disciplines with the aim of implementing its principles in the world of design. Studying the process of managing urban form in relation to adaptation capacities has become an important priority in the global scene too. A preliminary introduction to urban resilience capacities is the goal of this research. Therefore, this research has tried to unveil the resilience attributes which sync with urban design principles and introduce them as a set of features that can be used to build up guidelines and documents for delivering resilience.

INTRODUCTION

The concept of resilience has found its place among the priorities of most international to local agendas in cities and regions. The concept of resilience has many aspects from resistance to adaptation which all have a role in disaster risk reduction, although a big part of the current discourse comes from socio-ecological systems' concept and complex adaptive systems theory. A closer look at resilience attributes in the literature shows how related the characteristics of cities are to adaptation capacities. More clarification of resilience is needed in practices such as urban planning and design because.

There are many groups of scholars and organizations, movements and NGOs are dedicated to discuss the issues related resilience and its attributes now including but not all: the Stockholm resilience centre, Rockefeller foundation, UNISDR, ICLEI and most major universities around the world as it has become an important and popular issue. Many key scholars of resilience have coedited articles and books relating the basic concepts to the mentioned issues. One of the most general definitions of resilient cities which is a summary if almost all the main mentioned agendas is about keeping or promoting capacities which enables them to bounce back or absorb chronic or sudden disturbances in any part of their system or the whole and yet function and keep the existing structures and identity or even move to a higher more adaptable state.

The knowhow of the synthesis of urban design with resilience concepts will help disaster resilience. Studying the process of managing urban form in relation to adaptation capacities has become an important priority in the global scene too. A preliminary introduction to urban resilience capacities is the goal of this research.

1. RESILIENCE OF WHAT TO WHAT?

As Carpenter et al. (2001) point out, resilience is a relative concept and hence giving a clear definition for resilience depends a lot on what a system is facing because of the ever changing nature of aspects in today's world. "Depending on the temporal, social and spatial scale at which the measurement is made". They argue that measuring resilience needs specification of the spatial, temporal scales using models (Carpenter et al., 2001). They also believe that, "it is crucial to specify what kind of system state is being considered (resilience of what) and what perturbations are of interest (resilience to what) the measurements that are made in models are based on size of basins of attraction derived from quasi-steady-state analyses".

2. RESISTANCE AND RESILIENCE

In many definitions and reviews of resilience, it is considered to be closely related and sometimes equal to *resistance* particularly in disaster management and engineering. In modelling stress resistance and resilience as Norris et al. (2007) define them in case of disaster readiness, "resistance happens when the "resources are sufficiently robust, redundant or rapid" to be able to lessen and mitigate the sudden consequences of a shock in a way that the system continues to go on functioning whereas there is resilience when "a return in functioning", adaptation or transformation in the system happens due to that change. They claim that "the more severe, enduring, and surprising the stressor, the stronger the resources must be to create resistance or resilience" (Norris et al., 2007). Carpenter et al. (2001) claimed that "two systems (or one system at different points of time) may have the same resilience but differ in their resistance as measured in terms of how much they are displaced (or disturbed) by a given physical force or pressure".

3. RESILIENCE AND VULNERABILITY

The concept of vulnerability which is extensively discussed by many scholars such as Pelling (2002, 2003 and 2011) as part of resilience definition. For example as Feinstein (2013) narrates New York Time's (2012) for connecting the two, the purpose of resilience is to help vulnerable people deal with unforeseeable disruptions. According to Haimes (2009) "vulnerability and resilience are manifestations of the states of the system. In principle, they are two sides of the same coin." There are many discussions on equality of resilience vulnerability reduction (Berkes, 2007; Miller et al., 2010). With the difference that vulnerability is about safeguarding the system from damage and disruption whereas resilience is about bouncing back and recovery after a shock which is used in disaster management as well which lead to prepared need as well and is out of the scope of this research. Carpenter et al. (2001) define vulnerability as lack of a suitable level of robustness, redundancy in the resources that will lead to dysfunction. Davoudi (2012) believes that shedding light on the resilience and the related concepts of vulnerability and risk will help us have understood the environment in order to protect it from threats.

4. RESILIENCE, RISK MITIGATION AND DISASTER MANAGEMENT

The concept of resilience of cities is so vast regarding versatile types of disasters and shocks to the cities that each has led to substantive discussions, books, researches and studies on relationship between resilience and risk reduction, including tsunami, earthquake, climate change and terrorist attacks (including but not all: Godschalk, 2003; Paton and Johnston, 2006; Vale and Campanella, 2005; Pelling, 2002 and 2003). But what is interesting in resilient cities discussion is as Vale and Campanella (2005) argued, "The perceived source of a given disaster also profoundly affects urban resilience". They continue to emphasize on different scales of destruction, forms and affected areas and scope of affected groups that leads us back on the importance of discussing resilience in different cases and against specific stressors.

In addition, they see recovery which is another affiliated word with resilience in many arguments about it, as an on-going process which can actually contribute to cultural, symbolic and identity growth of the cities such as Mexico City and New York as they got through the traumas which again the emphasis on the ongoing process of transformation resonates with the research question. They (Vale and Campanella,



2005) believed that “resilience cannot be seen as good or bad” and that “we should focus on what gets transformed rather than on what parts return to the pre- disaster status”.

5. URBAN RESILIENCE AND ADAPTATION

It seems that in the times of rapid changes and transformations which new paradigms, unforeseen problems and unpredictable challenges are arising fast, it is felt more than ever that we need more adaptive viewpoints in our urban decision making and plans as well. That is why resilience and adaptation have become an important part of toolkits for thinking about development issues from strategic and national scales to local and neighbourhood scales. As Hillier (2011) argues, ‘strategic spatial planning is an adaptive practice concerned with what can be done in the face of uncertainty’. Many countries, regions and cities have set resilience as part of the vision statement or one of the main components of in their strategic plans.

Although resilience has many uses in various disciplines from economy to biology and ecology, it has just recently found its established its place in urban studies especially in relation to resilience. The resilience attributes are tailor-made to find answers to disasters management and mitigation: Godschalk (2003); Pelling (2003); Paton and Johnston (2006) as well as how cities recover and revive, Vale and Campanella (2005) has moved to climate change and peak oil and adaptation: Newman et al. (2009 a&b), Otto-Zimmermann (2011); ICLEI; Davoudi (2012) among many, urban food and farming, terrorism and all the major issues but now the focus is becoming more on strategic planning, planning for transformations and future of planning as well: (Hillier, 2007; Wilkinson (2010 and 2012) and even moving to issues such as urban justice and resilience (Feinstein, 2013), which seems to be partly because of the prominence of uncertainty and change among other issues which has made the key concepts to move from resistance to adaptation and even transformation.

There are many definitions for resilient cities depending on the view point different urban managers and researchers’ have which vary from promoting risk reduction, urban farming, reducing climate change effects or dealing with oil and economic crisis. But I think that McCubbin (2001) gives a comprehensive definition:

“A resilient city is one that has developed capacities to help absorb future shocks and stresses to its social, economic, and technical systems and infrastructures so as to still be able to maintain essentially the same functions, structures, systems, and identity”.

Newman et al. (2009) describe four scenarios for the future of the cities: Collapsed, ruralized, divided or resilient cities. The fourth scenario which is the “resilient city” describes a state when “the access and alternate forms of fuel and buildings in eco-enclaves are provided for all, people will have access to jobs and services by transit or walking with green building and design and infrastructures”. They picture them as having developed transit centres and corridors as well as urban eco-villages that will help them to run the city’s ecological functions as a lively system and local management.

Vale and Campanella (2006) argued that resilient cities are these which have the capacity to rebound from situation which was related to engineering resilience but as Gunderson (2010) argues it has moved further to involve community resilience as part of it (Wallace and Wallace, 2008) to what he called:

“A regime change in which structures, processes and identity of a community can evolve into a more desired configuration or devolve into a less desirable state.”

Although some groups such as Resilient City group (2012) emphasize on maintaining those “functions, structures, systems, and identity”. According to Carmin et al. (2011), there is not and should not be a generic model for approaching the adaption issues. Each city must find different fitting solutions for adaptation measures based on their socio-political contexts. Benzie (2011 has pursued this observation):

“no single approach will across all contexts but rather multiple approaches must be taken in order to achieve the common goal of adaptation, based on existing sectorial and cross cultural agendas at the city level”.

Newman et al. (2009 and 2011) push the concept of resilient cities one step further than “sustainable cities” and add “the transformational aspects of the changes needed within cities to adapt to the long term challenges facing the planet such as climate change and resource scarcities.” They introduce seven characteristics of resilient cities: “the renewable energy city, the carbon-neutral city, the distributed city, the biophilic city, the eco-efficient city, the place-based city and a sustainable transport city.” They give examples of urban infrastructures, transit oriented systems (TOD), local sources such as urban farms and



emphasis on localism and increasing social cohesion and locality in neighbourhoods and self-sufficiency as solutions based on the resilience literature.

Summarizing what is said by all the mentioned studies above, we can list the main attributes of resilient cities as following: self-organization, diversity, redundancy, modularity, resourcefulness, independence of parts, social capital, sense of place, ease of access to sources and leaning, although the list can go on depending on the type of resilience on the agenda and the local cases special conditions.

6. AN INTRODUCTION TO URBAN DESIGN AND RESILIENCE

To achieve resilience, a multidisciplinary effort among development specialists, urban planners and designers, economists, engineers, disaster managers, ecologists, and social scientists across disciplines is needed. Additional understandings and principles are being used in or emerge in social and ecological sciences are strengthening their links with urban design as a discipline which is involved in shaping the urban form and life in public spaces.

This cooperation is needed to deliver spatial heterogeneity in urbanized areas, integration of socio-ecological patterns and coherent dynamics in the cities to increase the adaptation levels of people and human institutions.

There are different viewpoints on resilient cities that all of them cannot be covered in this article. I will be focusing more on the basic definitions which lead us to increasing transformation capacities. Bruneau et al. (2006) theorized that resilient systems have four key properties, two of which can be synced with urban design attributes. With a referral to resilience discussions, they present the following characteristics:

It seems the place-based feature of resilient cities is the closest among the mentioned types to the urban design view point. According to Newman et al. (2009), "The place-based city is "place-oriented and locally self-sufficient". It will be a more sustainable place with a smaller ecological footprint, with more humanly infrastructures.

Robustness is "the ability to cope with stress without suffering deterioration". Longstaff (2005) argues that "a resistant or resilient system is robust if it can deal with a wide range of dangers, but it is fragile if it inflexible and can only function under a small number of possible scenarios". Robustness is used as one of the attributes for urban public spaces based on several urban theorists (e.g.: Carmona, 1996; Cuthbert, 2007). Redundancy as the extent to which elements are substitutable in the event of disruption or degradation. Many technological systems (airplanes, power grids) have complicated, and forethought redundancy plans. Societies build in redundancy by incorporating into larger networks or providing more problem solving options. A condition related to redundancy is "resource diversity." Communities that are dependent on a narrow range of resources are less able to cope with change that involves the depletion of that resource, a state that is sometimes referred to as "resource dependency" (Adger, 2000). Resource dependency is somewhat the opposite of redundancy. Expansion of urban farms which is happening in many cities has become part of urban resilience agenda as one of examples of decreasing resource dependency.

In addition, "Sense of community" can be added from the literature according to Perkins et al. (2002) an attitude of bonding (trust and belonging) with other members of one's group or locale, including mutual concerns and shared values. Sense of community which is part of urban design principles, is also characterized by high concern for community issues such as respect for and service to others, sense of connection, and needs fulfilment, is assumed to be a dimension of community capacity as Goodman et al. (1998) argue. It is also believed to be an attribute of resilient communities (Ahmed et al., 2004; Landau and Saul, 2004; Pfefferbaum et al., 2005; Tse and Liew, 2004).

Place attachment, is another attribute which urban designers try deliver is closely related to one's sense of community according to Tartaglia (2006). It implies an emotional connection to one's neighbourhood or city and its people according to Altman and Low (1992), Manzo and Perkins (2006) and Brown and Perkins (1992). Place attachment often underlies citizens' efforts to revitalize a community or bring it back from the state of decline which according to Perkins et al. (2002) is also a resilience attribute. Folke et al. (2003) and Paton (2006) are among many who have recognized sense of place as an adaptation trait. In other words, creating or enhancing a sense of place in towns and cities and feeling of belonging will not only enhance people's perception of the quality of their living space but will also promote resilience by raising their attachment to place, their collaboration in times of disaster and their ability to recover after the impacts. Urban design can facilitate the reconstruction process by safeguarding local cultural, social and



environmental values, which may be ignored or undervalued by developers and disaster managers. As it is a participatory discipline, it enhances community resilience by ensuring that stakeholders are consulted and included in decision-making processes in all stages so it will emphasize on social and human aspects of public realms. McDougal and Lasswell (1959) also emphasize on diversity, as another important attribute. The diversity of the various systems that comprise our cities is important because with greater diversity comes an increased ability to thrive, survive and bounce back from external shocks and stresses. Diversity of systems reduces the potential negative impact to the whole city of the failure of any one particular system. Modularity and Independence of System Components are introduced by Levin and Lubchenco (2008:27-32) as another resilience capacity. It will be increased when system components have enough independence that damage or failure of one part or component of a system is designed to have a low probability of inducing failure of other similar or related components in the system.

7. DISCUSSION

According to the resilience literature, adaptation capacities include a vast range of characteristics which vary due to what type of resilience is sought from climate change to natural disaster management, terrorism to economic recessions or socio-ecological transformations. These characteristics which resonate with urban design principal, include adaptability, robustness, connectivity, diversity, density, mix, social inclusion, self- organization and redundancy and place attachment. As said, the conflation of these viewpoints makes the results of this research valuable to all these significant fields.

It seems that resilience is a valuable viewpoint to confront the ever spreading and expanding complex urban issues which round the globe. There is a lot to be learned and tested in practice, but it seems the resilience attributes of socio-ecological systems can be tailored and synced to urban design principles and in fact have a lot in common. Iran's main threat for urban areas are earthquakes which can be counted not as a sudden stressor according to the resilience literature, but the consequences have multiple chronic effects in the affected areas and the surrounding regions, sometimes in the national level. Tackling this disaster from a resilience point of view in urban areas can be a step forward in achieving well-being and promoting life not in Iran but on the global scale.

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REFERENCES

- Berkes F, Colding J et al. (2002) Navigating social-ecological systems: building resilience for complexity and change / edited by Fikret Berkes, Johan Colding, and Carl Folke, New York; Cambridge, UK: Cambridge University Press
- Berkes F, Folke C et al. (1998) Linking social and ecological systems : management practices and social mechanisms for building resilience/edited by Fikret Berkes and Carl Folke; with the editorial assistance of Johan Colding, Cambridge, U.K.; New York, NY, USA: Cambridge University Press
- Berkes F (2007) Understanding uncertainty and reducing vulnerability: lessons from resilience thinking, *Natural Hazards*, 41(2): 283-295
- Bodin P and Wiman B (2004) Resilience and other stability concepts in ecology: Notes on their origin, validity, and usefulness, *ESS Bulletin*, 2(2): 33-43
- Brand FS and Jax K (2007) Focusing the meaning (s) of resilience: resilience as a descriptive concept and a boundary object, *Ecology and society*, 12(1): 23
- Bruneau M and Reinhorn A (2006) Overview of the resilience concept, Proceedings of the 8th US National Conference

on Earthquake Engineering

Carpenter S, Walker B et al. (2001) From metaphor to measurement: resilience of what to what? *Ecosystems*, 4(8): 765-781

Coyle SJ (2011) Sustainable and Resilient Communities: A Comprehensive Action Plan for Towns, Cities, and Regions, Wiley

Ernstson H, van der Leeuw SE et al. (2010) Urban transitions: on urban resilience and human-dominated ecosystems." *AMBIO: A Journal of the Human Environment*, 39(8): 531-545

Folke C (2002) Resilience and Sustainable Development: Building Adaptive Capacity in a World of Transformations, *AMBIO*, 31(5): 437

Folke C (2006) Resilience: The emergence of a perspective for social–ecological systems analyses, *Global Environmental Change*, 16(3): 253-267

Folke C, Carpenter S et al. (2002) Resilience and sustainable development: building adaptive capacity in a world of transformations, *AMBIO: A Journal of the Human Environment*, 31(5): 437-440

Folke C, Carpenter S et al. (2002) Resilience and Sustainable Development: Building Adaptive Capacity in a World of Transformations, *AMBIO*, (5): 437

Folke C, Carpenter SR et al. (2010) Resilience thinking: integrating resilience, adaptability and transformability, *Ecology and Society*, 15(4): 20

Godschalk DR (2003) Urban hazard mitigation: Creating resilient cities, *Natural Hazards Review*, 4(3): 136-143

Haines YY (2009) On the definition of resilience in systems, *Risk Analysis*, 29(4): 498-501

Handmer JW and Dovers SR (1996) A typology of resilience: rethinking institutions for sustainable development, *Organization & Environment*, 9(4): 482-511

Holling CS (1973) Resilience and stability of ecological systems, *Annual review of ecology and systematics*: 1-23

Holling CS and Gunderson LH (2002) Resilience and adaptive cycles, Panarchy: Understanding transformations in human and natural systems: 25-62

Kowalik M and Guaralda M (2011) Mapping resilience: A framework for changing cities, Proceedings of 4th International Urban design Conference, AST Management Pty Ltd

Levin SA and Lubchenco J (2008) Resilience, robustness, and marine ecosystem-based management, *Bioscience*, 58(1): 27-32

Levin SA, Barrett S, Aniyar S, Baumol W, Bliss C, Bolin B and Sheshinski E (1998) Resilience in natural and socioeconomic systems, *Environment and Development Economics*, 3(02): 221-262

McCubbin L (2001) Challenges to the Definition of Resilience

McDougal MS and Lasswell HD (1959) The Identification and Appraisal of Diverse Systems of Public Order, *The American Journal of International Law*, 53(1), 1-29

Miller F et al. (2010) Resilience and vulnerability: complementary or conflicting concepts, *Ecology and Society*, 15(3): 11

Newman P, Beatley T et al. (2009) Resilient cities: responding to peak oil and climate change, Island Press

Norris FH, Stevens SP et al. (2008) Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness, *American journal of community psychology*, 41(1): 127-150



- Norris FH, Stevens SP et al. (2008) Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness, *American journal of community psychology*, 41(1): 127-150
- Otto-Zimmermann K (2011) Resilient Cities: Cities and Adaptation to Climate Change-Proceedings of the Global Forum 2010, Springer
- Pelling M (2003) The vulnerability of cities: natural disasters and social resilience, Earthscan
- Pendall R, Foster KA et al. (2010) Resilience and regions: building understanding of the metaphor, *Cambridge Journal of Regions, Economy & Society*, 3(1): 71-84
- Pickett ST, Cadenasso ML, et al. (2004) Resilient cities: meaning, models, and metaphor for integrating the ecological, socio-economic, and planning realms, *Landscape and urban planning*, 69(4): 369-384
- Slootweg R and Jones M (2011) Impact Assessment and Project Appraisal, Resilience thinking improves SEA: a discussion paper, Taylor & Francis
- Vale LJ and Campanella TJ (2005) The resilient city: How modern cities recover from disaster, Oxford University Press, USA
- Walker B, Holling CS et al. (2004) Resilience, Adaptability and Transformability in Social-ecological Systems, *Ecology and society*, 9(2): 5
- Walker BH and Salt D (2006) Resilience thinking: sustaining ecosystems and people in a changing world / Brian Walker & David Salt; foreword by Walter V. Reid, Washington: Island Press
- Walker BH and Salt D (2012) Resilience practice: building capacity to absorb disturbance and maintain function / Brian Walker & David Salt, Washington, DC: Island Press
- Walker J and Cooper M (2011) Genealogies of resilience From systems ecology to the political economy of crisis adaptation, *Security Dialogue*, 42(2): 143-160

