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Planning the resilient city: Concepts and strategies for coping with climate change and environmental risk

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ABSTRACT

This paper contributes to filling the theoretical and practical gaps of city resilience literature, which lacks multifaceted theorizing and typically overlooks the multidisciplinary and complex nature of urban resilience. Furthermore, most studies on the subject make use of general, vague, and confusing terminology. This paper suggests a new innovative conceptual framework (the Resilient City Planning Framework or RCPF) that addresses the critical question of what cities and their urban communities should do in order to move towards a more resilient state in the future. Accordingly, the RCPF takes complexity and uncertainty into account. It is affected by a multiplicity of economic, social, spatial, and physical factors and its planning involves a wide range of stakeholders. RCPF is a network of four interlinked concepts that together, provide a comprehensive understanding of City Resilience.

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Introduction

In recent years, we have become increasingly aware of the huge risks that climate change poses to our cities. Climate change is likely to bring higher temperatures, sea level increase, more intense rainstorms, droughts and heat waves. It also poses particular threats to urban infrastructures. To name just a few, these include increased strains on materials and equipment, higher peak electricity loads and voltage fluctuations, transport disruptions, and increased need for emergency management (IPCC, 2007; NPCC, 2009; Wardekker et al., 2003). Furthermore, we have recently witnessed how natural disasters have cost lives and destroyed urban spaces and communities (Munn-Venn & Archibald, 2007). The tsunami and earthquake in Japan, the tsunami in the Indonesian island of Sumatra, and the flood covering large areas in Pakistan and Australia, which have taken tens of thousands of lives, are just a few among many tragic disasters. Importantly, the issue at stake is not the climate change impacts alone but "... a whole spectrum of global environmental changes that interplay with interdependent and rapidly globalizing human societies" (Folke et al., 2011) and the resulting risks that human settlements and humanity in general may face. It is clear that, in order to reduce the risk and impact of these threats and to increase the safety and wellbeing of their residents, cities and their communities must be more resilient and prepared to address the threats head-on. If they are not, their urban communities will live under continuous threat, and more and more will become vulnerable to risks (UNISDR, 2010).

The critical question is, how resilient are contemporary cities and their different communities, and are they ready to face a multiplicity of challenges and uncertainties in the future? Most importantly, what should cities and urban communities do, at the present, in order to move from a vulnerable to a more resilient state? Moreover, since human action contributes to the altering of the ecosystem locally and globally (Chapin et al., 2011; Folke et al., 2011), how resilient should cities be in order to contribute to environmental protection and sustainability? Although a literature review reveals an important emerging scholarship on urban resilience, most studies on the subject make use of general, vague, and confusing terminology, and fail to conceptualize and theorize the phenomenon in a systematic manner. Therefore, this paper aims to fill the theoretical and practical gaps and answer the critical question regarding what cities and their urban communities should do in order to move towards a more resilient future state.

The problem of resilience

The concept of resilience, in the urban context, was borrowed from studies on the manner in which ecological systems cope with stresses and disturbances caused by external factors (Davic & Welsh, 2004). From an ecological perspective, Holling (1973), who may be the first to define it (Barnett, 2001; Carpenter, Walker, Anderies, & Abel, 2001), suggests that resilience is "the persistence of relationships within a system" and "the ability of these systems to absorb changes of state variables, driving variables, and parameters, and still persist" (Holling, 1973, p. 17). In other words, resilience is "the capacity of a system to undergo disturbance and maintain its functions and controls" (Gunderson & Holling, 2001).

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Recently, the concept has also been applied to human social systems (Adger, 2000; Leichenko, 2011; Pelling, 2003); ecological urban resilience (Andersson, 2006; Barnett, 2001; Ernstson et al., 2010; Folke, 2006; Maru, 2010); economic recovery (Rose, 2004; Martin & Sunley, 2007; Pendall, Foster & Cowel, 2010; Pike, Dawley, & Tomaney, 2010; Simmie & Martin, 2010), disaster recovery (Colten, Kates, & Laska, 2008; Cutter, Boruff, & Shirley, 2003; Pais & Elliot, 2008; Vale & Campanella, 2005; Coaffee et al., 2008; UNISDR, 2010), and urban security and resilience against post-September 11th terrorism (Coaffee, 2006, 2009). Inspired by the concept of the resilient ecosystem, “resilience means the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to 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” (UNISDR, 2010, p. 13).

Apparently, a striking weakness of the scholarship on the subject is its lack of multifaceted theorizing and the fact that it typically overlooks the multidisciplinary and complex nature of urban resilience. Because city resilience is a complex, multidisciplinary phenomenon, focusing on a single or small number of contributing factors ultimately results in partial or inaccurate conclusions and misrepresentation of the multiple causes of the phenomenon. Folke and others (2010) suggest that resilience is about dynamic and complex systems, which is characterized by multiple pathways of development, interacting periods of gradual and rapid change, feedbacks and non-linear dynamics, thresholds, tipping points and shifts between pathways, and how such dynamics interact across temporal and spatial scales (Folke et al., 2011, p. 721). Godschalk (2003, p. 14) contends that if we want to take urban resilience seriously, we need to build the goal of a resilient city in a multidisciplinary manner. Richard Little (2004) posits that resilience is about more than just physical robustness and will be less effective if restricted to a narrow discipline. Moreover, some scholars argue that critical urban issues “are typically treated as independent issues,” and that “this frequently results in ineffective policy and often leads to unfortunate and sometimes disastrous unintended consequences” (Bettencourt & Geoffrey, 2010). In this context, Bettencourt and Geoffrey (2010, p. 912) conclude that “developing a predictive framework applicable to cities around the world is a daunting task, given their extraordinary complexity and diversity”. Leichenko (2011, p. 164) concludes that urban resilience studies are grounded in a diverse array of literatures, and “while there is much overlap and cross-fertilization among these different sets of literature, each emphasizes different facets of urban resilience and each focuses on different components of cities and urban systems.”

Another gap in the literature is related to measuring resilience and how to assess a system’s resilience in general and urban resilience in particular. Mostly, the literature of resilience measurements has focused on ecosystems, and suggests quantitative indicators for such assessment. According to Gunderson and Holling (2001), resilience is measured by the magnitude of disturbance that can be experienced without the system flipping into another state and within which the system can absorb and still persist. Carpenter et al. (2001) suggest measurement of socioecological systems (SES) that focuses on its capacity. It appears that the resilience concept has been applied mostly to understand social–ecological systems and dynamics in areas that suffer disaster, rural communities in developing countries, and for improving livelihoods (Chapin, Kofinas, & Folke, 2009; Eakin & Wehbe, 2009; Enfors & Gordon, 2008; Folke et al., 2011; McSweeney & Coomes, 2011; Walker, Anderies, Kinzig, & Ryan, 2006; WRI, 2008). To sum up, the literature on measuring resilience overlooks cities and ordinary communities (see also Castello, 2011).

One example of this type of treatment is the new campaign launched by the United Nations International Strategy for Disaster Reduction in 2010, entitled *Making Cities Resilient* (UNISDR, 2010). The campaign aims to “promote awareness and commitment for sustainable development practices that will reduce disaster risk and increase the wellbeing and safety of citizens – ‘to invest today for a better tomorrow’” (UNISDR, 2010). The UNISDR proposes a general and limited scope checklist of ten essentials to empower local governments and other agencies to implement the *Hyogo Framework for Action 2005–2015*. This framework focuses on “Building the Resilience of Nations and Communities to Disasters” (UN/ISDR, 2005), which was adopted by 168 governments in 2005. In *Resilient Cities*, Newman, Beatley, and Boyer (2009) also focus on only one dimension of resilience: the oil crisis. In this context, they point out that “a danger that few think about with such immediacy is the threat of the collapse of our metropolitan regions in the face of resource depletion – namely, the reduction in the availability of oil and necessary reduction in all fossil fuel use to reduce human impact on climate change” (p. 2). In this way, their book focuses less on urban resilience and more on “the challenges posed to metropolitan areas in the face of responding to their increased carbon footprint, dependence on fossil fuels, and impact on the irreplaceable natural resources” (2009, p. 2). In *The Resilient City*, Vale and Campanella (2005) focus on the narratives of resilience, the symbolic dimensions of disaster and recovery, and the politics of reconstruction. They argue that, to understand urban resilience is to understand the ways in which human narratives are constructed to interpret the meanings of urban reconstruction. *The Resilient City* by Walisser, Mueller, and McLean (2005), which was prepared by the Vancouver Working Group for the 2006 World Urban Forum, explores the resilience of small Canadian communities dependent on single resource industries by examining how they have coped with the economic and social pressures arising from widespread closures.

In summary, the major theoretical challenge regarding urban resilience facing many scholars today appears to be the development of a multidisciplinary theory that integrates a variety of urban dimensions such as social, economic, cultural, environmental, spatial and physical infrastructure, into a unified conceptual framework for understanding the resiliency of cities and how they should move towards a more resilient state. Therefore, this paper aims to fill the theoretical and knowledge-based gaps in this critical field by investigating the phenomenon of city resilience and developing a new multidisciplinary conceptual framework for understanding the complexity of urban resilience. In other words, this paper seeks to construct a more rigorous, careful basis for promoting and assessing resilience of cities.

Methods

By nature, working on urban resilience requires “complex thinking and complex methods” (De Roo & Juotsiniemi, 2010, p. 90), and it also forces us to adopt a more holistic view (Batty, 2007). The basic assumption of this paper is that city and community resilience is a phenomenon that is complex, non-deterministic, dynamic in structure, and uncertain in nature. It is a phenomenon that is affected by a multiplicity of economic, social, spatial, and physical factors. Its planning involves a wide range of stakeholders including civil society, local and national governments, the private sector, and various professional communities, and it therefore affects a variety of urban communities and city residents.

In order to build the conceptual framework, a qualitative analysis method was used. This method is a grounded theory technique that attempts to “generate, identify, and trace a phenomenon’s

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