



International High- Performance Built Environment Conference – A Sustainable Built Environment Conference 2016 Series (SBE16), iHBE 2016

## Are some forms of resilience more sustainable than others?

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### Abstract

Cities currently host more than half of the world population, a number which is projected to continue to rise. Urban centres also create large percentages of national gross domestic product (GDP) and are important sources of employment but also generate large proportions of national greenhouse gas emissions. Climate change and fast technological progress, among other factors, will bring considerable challenges for urban policy-makers and implementers. They will need to be able to keep pace with the unforeseeable and a future that will be significantly different from past experience, while also aiming to maintain and increase liveability and social well-being. This is leading local, state and national governments as well as international organisations to start developing and implementing resilience policies. However, what it is meant by “resilience” might be significantly different in each case, making comparison of policies and proposals a complex issue. To complicate things even further, in addition to the many established definitions of the term which have been coined over the years, many policies and academic publications on the topic lack a clear definition of the type of resilience they seek to address. The present work explores some established resilience concepts and their policy implications as well as the new concept of *sustainable resilience*. This publication then explores the question of whether some forms of resilience are more sustainable than other from an urban policy perspective.

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Peer-review under responsibility of the organizing committee iHBE 2016.

*Keywords:* Resilience; urban policy; cities; sustainable;

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### 1. Introduction

Cities have a central role in today's economy; they host more than half of the global population and are at the epicenter of a country's economic growth as well as their environmental impact. Because of this trend, many

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organizations around the world, including government and non-governmental organizations, have started focusing their attention on cities, their impact and their ability to survive [1]. Within this context, the word *resilience* is increasingly used in policies, government programs and other urban initiatives. However, its meaning may be different for each of those policies or initiatives. This is supported by extensive literature reviews such as Meerow et al. [2] and Manyena [3] that found 25 and 12, respectively, distinctly different concepts of resilience.

With such a wide range of definitions for a term that is becoming increasingly prominent in urban policy, this publication asks the question: *are some forms of resilience more sustainable than others?* At first glance, this question may seem like an oxymoron. To many, resilience is sustainable by definition. The literature however suggests otherwise. Sanchez et al. [4] proposed four main characteristics of *sustainability* when considered as an approach or abstraction: adaptive/dynamic; sustained/persistent; preventive/proactive, and holistic. Within a resilience and policy context, this helps deconstruct the original question to analyse both policy and literature. Are the authors or policy-makers striving or advocating for an adaptive/dynamic system? Are they advocating for a form of resilience that can be sustained over the long-term? Are they taking a proactive approach with a focus on long-term futures or are they promoting a reactive one? Are the views of the issues and system holistic or do they have a narrow focus?

The following sections will explore this topic within a policy context based on a literature review. It will then examine some of the main criticisms made by the literature about the ability of policy to create or promote forms of resilience that can endure or be sustained over the long term. It then seeks to answer the question, if there are some forms of resilience that are more sustainable than other, are they being used for policy development? And if not, why?

## 2. Methodology

This paper presents the early findings from an initial thematic analysis and review of published resilience literature within an urban policy context. The inclusion criteria were: academic and policy papers and book chapters discussing urban resilience, sustainability thinking, resilience thinking, sustainable resilience, proactive resilience, and resilience and climate change policy; papers published in English; and papers published since 1970. This initial literature review included 74 references. The initial search was done through Google Scholar, Scopus and the UNSW Library Catalogue, however it was then extended based on references found in relevant publications. The four overarching values or principles of *sustainability as an approach* proposed by Sanchez et al. [4] were used to catalogue and analyse the literature about resilience concepts and resilience policy. This led to a classification of resilience concepts according to the range of disturbances they focus on and whether they focus on short-term or long-term futures.

Within the context of this research, policies are understood as the positions taken and articulated by government and other organizations that recognize a problem and state, in general terms, the actions to be taken to address the problem [5]. These are composed of a set of objectives, targets, instruments and agents [6]. Within the context of this research the term urban is understood as a system formed by a conglomeration of ecological, social and technical components. These form socio-technical, socio-ecological and eco-technological networks, where each component and their networks are dynamically changing and interacting with each other in often unpredictable ways. This concept builds on the characterisation of urban systems provided by Meerow et al. [2].

## 3. Resilience as a concept

There is a growing body of literature about what resilience means for ecosystems and more recently urban settlements. The academic literature has been particularly prolific in providing different interpretations of the term. A recent literature review analyzed 172 resilience studies and found 25 distinct definitions of the term. Half of the definitions were centered on a specific threat and 40 percent focused on a static (single-equilibrium) view of resilience [2]. Even within disaster-focused resilience literature there is a range of definitions. Manyena [3] for example was able to separate 12 definitions.

Besides academic authors, international organizations such as the World Bank, United Nations and the Rockefeller foundation as well as local and national bodies such as Australia's Resilience Task Force and the New

York City Special Initiative for Rebuilding and Resilience are also promoting the idea of more resilient cities [7, 8, 9, 10, 11]. However, these efforts are guided by different interpretations of the term *resilience*.

Going back to the original meaning of the word, the term entered the English language in the early 19<sup>th</sup> century referring to “the ability to recover from adversity” and later to describe “strength and ductility of steel beams” [12]. In 1973, the concept was introduced to the ecological literature. Within this field, the most successful definition is perhaps that published by C.S. Holling who applied it to ecosystems and highlighted the implications for resource management [13]. Over the last 40 years this concept has continued to evolve into a number of types of resilience applied to different scopes. However, what often seems to be missing in the literature is an exploration of what these different interpretations mean in terms of policy development and evaluation. From an academic perspective, the question could also be asked as to whether the diverse nature of challenges faced by different cities and their local context are driving the understanding of resilience rather than resilience-thinking driving the way that the challenges are addressed.

When urban resilience policies are studied, many are based on either engineering or ecological resilience concepts. Both approaches are equilibrium-based concepts that focus on the ability of cities to bounce back after a shock event to a “normal” or equilibrium state [13]. The implication of using this type of concept is that resilience policy also tends to be reduced to emergency response with an emphasis on short-term damage reduction and recovery. This tendency may be driven by the perception of the challenges presented to cities and the windows of opportunities they represent [14]. The question now posed is whether this approach will be suitable to address, in a sustained manner, the diverse range and scales of challenges urban settlements will have to face over the coming decades. Many of these will involve chronic stress in addition to shock events. Shock events may also become difficult to predict and, when they strike, the question remains of whether the smartest choice is to “return to normal”, and what “normal” means. Klein et al. [15] for example highlight that if a city experiences disaster, this means that the original state was vulnerable to it and therefore should be an undesirable state to go back to because it would perpetuate this vulnerability. On the other hand, when policies focus only on one type of stress, we could also ask: are we missing an opportunity to leverage public funds for more integrated resilience policies that address a wider range of stresses? And, should we be addressing the source as well as the consequences?

A different approach to resilience has however been gaining momentum in academic and policy literature in recent years. This is a socio-ecological systems approach which is based mainly on three aspects: (i) being able to absorb disturbances while remaining within a “normal” or acceptable state; (ii) capacity to self-organise; and (iii) being able to build capacity for learning and adaptation [16]. This concept acknowledges that cities are complex systems which are constantly changing in an often unforeseeable way. Although not a core characteristic of the concept, it also sometimes includes technology as an important influencing aspect which can be positive or negative. Most literature on this area however often fails to consider dynamic technological changes and interactions with emerging socio-technical systems [17]. It also raises the same question of what “normal” or “acceptable” means [14].

Similar in some aspects and sometimes used as a synonym to socio-ecological resilience, evolutionary resilience has also begun to take hold relatively recently. This concept also challenges the idea of the existence of an equilibrium and advocates for understanding cities not only as complex but also as dynamic and constantly changing systems. In terms of policy this concept implies seeing recovery as an opportunity to re-build the city into an optimized or improved system. It presents resilience as a continually changing process rather than an end-objective. As with socio-ecological resilience, this concept focuses on disturbances which can be chronic slow stresses or acute rapid shocks [14]. This concept, however, also falls short by not accounting for the dynamic role of technology within cities and only highlights disturbances as opportunities rather than taking a more coordinated proactive approach to risk mitigation and adaptation within the urban planning context.

Bosher’s 2008 book [18] is perhaps one of the first publications found in this research where a resilient built environment is explored in detail. This publication was later used to develop the built-in resilience concept, which is defined as “a quality of a built environment’s capability (in physical, institutional, economic and social terms) to keep adapting to existing and emergent threats” [19]. This concept focuses on the idea of intuitively and proactively coping with dynamic changes. Bosher’s is an interesting concept because it explores practical implications of resilience thinking for built environment practitioners. Supporters of this term for example suggest a mix of

structural and non-structural solutions to operationalize the concept while acknowledging the difficulties of doing so due to the complexity of the task. Another interesting implication of built-in resilience is the interpretation that discussing disasters as “natural” can be counterproductive in policy development because it “absolves many stakeholders from blame” [20]. This opens the door for mitigation to be considered as part of resilience more broadly and has led others to advocate for more integrated and proactive resilience planning. However, when studying Boshier’s original concept, this focuses on withstanding, recovering and mitigating extreme hazards, which limits the scope by not including chronic stress. Although Boshier [18] briefly explores social long-term stress such as economic downturn, this is only framed within the context of how it impacts the outcomes of extreme events. The literature about built-in resilience then also tends to focus only on disasters. See for example [19], [20] and [21].

There have been other concepts of resilience discussed briefly in the literature that have tried to reflect more enduring forms of resilience. Examples include “stable resilience”, which relates to the ability to avoid falling into “uncontrolled vulnerability” after a shock event happens [22]; “progressive resilience”, which builds on evolutionary resilience to include anticipatory and holistic approaches to achieve long-term goals rather than focusing on short-term programs [23], and “climate resilience” which focuses on mitigation and adaptation to climate change effects [24]. However, these have not been greatly explored in terms of how they can be operationalized into comprehensive policies and in the case of climate resilience, its narrow focus limits its application to a single source of stress.

Different resilience concepts also have significantly different policy implications. For example, the series of earthquakes that affected Christchurch in 2010-11 destroyed most of its central business district and large sections of residential suburbs. This created material losses equivalent to almost 20% of New Zealand’s GDP in addition to human losses [25]. If the local government had applied an equilibrium-based approach to resilience, the strategy would have been to recover as quickly as possible to return to the same configuration as prior to the earthquake. A socio-ecological resilience would lead it to also include adaptation initiatives so the rebuilding effort would make the city more tolerant to future disturbances, by for example changing building codes.

An evolutionary resilience approach would probably challenge the idea of rebuilding the city as it was and take a long-term view. This could for example lead them to lean towards a new configuration which could increase the tolerance of the city to a range of disturbances and improve other aspects such as livability. The new plan could for example create multiple central business districts (CBDs). This could in turn lead to more residential areas being within walking distance of commercial areas while also ensuring that if a new disaster event of similar intensity occurs 70% of the city’s productivity does not disappear overnight. Built-in resilience would probably have focused on assessing the seismic vulnerability of the building stock and initiating a retrofitting and construction strategy that included seismic design features before and after the event. In reality, the original Christchurch Central Recovery Plan was mostly aligned with an evolutionary approach to resilience. This plan included a new configuration divided into a compact “core” surrounded by a “frame” as well as new regulatory changes to the zoning and building codes [26]. This is however a long-term plan and the final outcomes will likely depend on political changes and social sentiment.

More recently, Sanchez et al [4] proposed a characterization of the term “sustainable resilience” which could also be called “enduring resilience”. This concept expands socio-ecological resilience to include technological networks and their interactions with social and ecological networks, as well as include short, medium and long-term mitigation. It is characterized by a sustained, proactive and coordinated approach to resilience policy implementation. This work aimed to fill the gaps outlined above in other concepts by focusing on characteristics that are highlighted in the literature as underpinning forms of resilience which can be sustained in the long term. After a systematic literature review Meerow et al. [2] independently came to the same conclusion regarding the gaps in current concepts. Importantly though, Sanchez et al.’s work focuses on urban policy and is expected to continue to focus on how to operationalize this concept. They also propose that in order to achieve this goal, the policies that underpin resilience efforts must themselves be resilient and are working on developing a practical framework to achieve this goal.

Going back to the Christchurch example, a sustainable resilience approach would focus on the outcomes as well as the process and policy structures involved in the ensuing strategy development and implementation. In the aftermath of the 2010-11 earthquakes there was, at first, a significant level of participation and collaboration at the grassroots level to develop plans for recovery [27]. However, the institutional capacity of the Christchurch local

councils was deemed insufficient to cope with the recovery task which led the Central Government to establish the Canterbury Earthquake Recovery Authority (CERA). While the intent was in line with a holistic approach to urban planning and aimed to developed a well-coordinated and efficient recovery strategy, the way CERA was implemented undermined this intent. CERA was given nine months to develop their strategy for a five year mandate, after which their wide range of powers would be transferred to pre-existing agencies [28]. CERA has been heavily criticized for marginalizing “the role of locally elected urban authorities in re-planning the city”, eroding institutional memory, disrupting pre-existing lines of communication, and weakening “effective public accountability and scrutiny” [29]. CERA has also been criticized due to its lack of independence from the Central Government’s political agenda, being top-down, centralized and highly bureaucratic, which could be argued are characteristics that arose due to how it was created. The Institute for Governance and Policy Studies based in Wellington also concluded that the decision to structure CERA the way it was established was likely driven by the Cabinet’s perception of political and fiscal risk. In addition to this, there were concerns about whether appropriate governance arrangements had been established to ensure integrated, well-coordinated and well-informed (with the right input) recovery activities over the longer term. Lack of coordination and communication across actors have also been reported as hindering implementation [28].

In short, although the initial policy approach chosen by New Zealand in the aftermath of the earthquakes was in line with sustainable resilience principles, in that it aimed to drive coordinated, holistic and long-term change, its implementation fell short by leaving key actors out of the process and therefore undermining the coordination effort and its long-term implementation. If a sustainable resilience concept had been used, one of the main outcomes would have probably been a process that aimed to have a long-term coordinated and cohesive approach to the strategy development and implementation that also took into consideration other sources of stress besides earthquakes. This would necessitate the inclusion of those parties that are closest to the community such as local councils and NGOs, as well as infrastructure agencies and other actors. In addition to the policy structures, sustainable resilience would require a proactive approach to short, medium and long-term risk mitigation. Within the long-term scope, recent studies have found that sea level rise projections for Christchurch and many other NZ coastal cities will significantly increase the risk of liquefaction, which worsen the impact of the 2010-11 earthquakes [30], as well as bring other problems. This connection between climate change and intensifying outcomes from earthquakes and other stresses would mean that the new strategy under a sustainable resilience approach would also need to consider a proactive approach to climate change mitigation. Finally, in terms of implementation, socio-technical networks and the way they dynamically change would also need to be considered as both part of the solution and the challenges yet to face. This could for example include the development of platforms that allow individuals at all levels of decision-making to access the information they require to make better decisions or the use of social media and data mining techniques to create both passive and active forms of engagement. The Resilient Christchurch program has recently published their resilience strategy for greater Christchurch and are actively working with CERA to address some of the issues highlighted above [27]. How these two policy structures work together to progress towards more holistic and sustainable forms of resilience is however yet to be seen.

**Error! Reference source not found.**Figure 1 graphically illustrates an estimate of how resilience concepts could be catalogued in terms of their time preferences and the types of events commonly discussed in the associated literature. It also provides an example of how the concepts discussed earlier could be mapped.

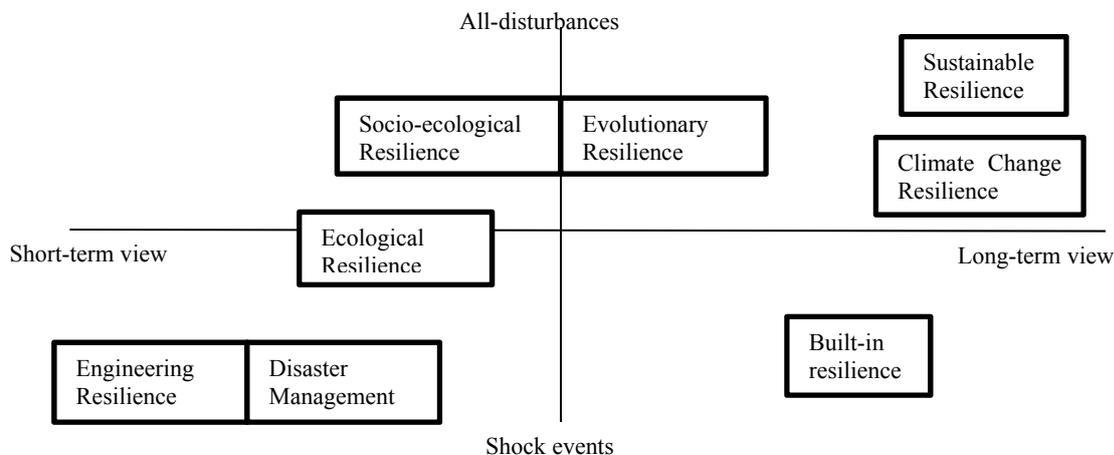


Fig 1 Resilience concept based on the time preference and types of events commonly associated to them

In addition to different types of resilience concepts, there are also different scopes to which they can be applied. Within the urban settlement context these concepts can for example be applied to the built environment or urban communities. Built environment resilience refers to man-made structures that provide the setting for human activity [31]. Community resilience on the other hand often refers to the resilience of the inhabitants of a human settlement (individually or as a group) and their social constructs. Literature about this topic often discusses issues such as government, economy and well-being. Norris et al. [32] define it in terms of four key characteristics: economic development, social capital, information and communication, and community competence.

Each scope also has significantly different implications for the development of urban resilience policy. For example, an engineering built environment resilience approach could aim to restore critical infrastructure to a functional state as quickly as possible. An engineering community resilience approach may on the other hand drive policy which aims to ensure that economic and social activities can be restored as quickly as possible. Thus, while one policy may focus on infrastructure recovery plans the other may focus on social outcomes such as economic recovery.

These two scopes are often combined within new descriptions of resilience used for policy development. For example, the Rockefeller foundation city resilience framework uses an expanded socio-ecological resilience concept which combines both built environment and community aspects [11]. This program includes globally and regionally influential cities such as Bangkok, London, New York, Paris, Singapore and Sydney [33]. The U.S. Resilience Project on the other hand, takes a tailored evolutionary resilience approach that has a clear focus on community resilience. While concentrating only on shock events, it sees them as opportunities to increase “productivity gains, customer satisfaction and shareholder value”. It also proposes that in order to increase resilience the actions must focus on members of the community (employees and critical stakeholders) [34].

#### **4. Sustainability of resilience policies**

Davoudi [35] argues that many resilience policies being established are in fact driving a new form of “resilient urbanism”. Focused on short-term emergency response and driven by the goal of quickly returning to a state of equilibrium after a sudden external shock, these policies often pay insufficient attention to chronic long-term stress sources. Moffat [36] refers to this phenomenon as the result of having “high time preferences”, which means valuing the present above the future. This trend, he argues, generates a perception of time which is incompatible with cycles that shape civilization and devalues the key idea of resilience. Civilizations are formed over long periods of time and focusing on short-term “wins” may threaten our long-term survival. Moffat goes further to say that “until time preferences change, progress towards resilience will be very slow, regardless of changes to public policy or technical expertise” [36].

Hassler and Kohler [37] highlight these strategies driven by high time preferences as “anticipatory”. They are commonly based on a centralized governance system, characterized by low levels of flexibility and capacity to learn. They argue that when the context of the system is defined by uncertainty, these strategies may lead to higher levels of vulnerability in the long-term. In such context, they contend, a resilience strategy based on integrating design rules that develop capacities to cope with uncertainty and learn from experience is better suited to ensure the persistence of the system, even if this means transformation.

Urban transformation may happen voluntarily or accidentally and can lead to unsustainable conditions too. Pickett et al. [38] add that strategies to avoid such outcomes would require active engagement in setting long-term goals, identifying resilience mechanisms that can help achieve those goals, and designing and managing for adaptive capacity. This long-term horizon for city planning makes clear the level of uncertainty about possible sources of risk and the potential for unintended lasting consequences of today’s actions. This is what Moffat [36] has called the “dark side of sustainability”. Understanding the city in these terms requires an integrated and coordinated new form of urban intelligence. The starting point of Canada’s CitiesPlus program for example was to develop a sustainability plan for Vancouver with a horizon of 100 years. This fact eventually led to the plan being reframed so resilience characteristics would be compatible with sustainability and livability principles. This required the engagement of over 500 professionals, 18 systems’ teams and a number of organizations, including the Canadian National Security Agency among others [36]. Within this long-term horizon resilience becomes a heuristic approach to dealing with epistemic uncertainty that accounts for low-probability, high-consequence events [39].

Nevertheless, examples of successful implementation of holistic and progressive urban resilience policies are rather limited. Vale [23] proposes that this is due to an asymmetry of priorities between government officials and long-term resilience action. Public officials are required to focus on short and medium-term goals linked to their election cycles. This limits the incentive to establish long-term horizons and invest in resilience initiatives that proactively target the root-causes of future problems and increase the capacity to respond in real-time to challenges as they arise. Another issue may be that resilience is often only addressed through infrastructure changes. As highlighted by Poole et al. [40], this brings additional challenges due to: the need for large capital investments, cost and revenue being uncertain over the long term, the lack of market mechanisms in public infrastructure, and path-dependency and irreversibility of investment.

Even from an adaptation-only point of view, current policies commonly take reactive approaches. These are here argued to be unsuitable to deal with complex long-term problems, such as a changing climate, because they are based only on past experience of punctual threats and incomplete information about future trends. A study of two surveys sent to all Norwegian municipalities for example found that the key factor that was common to municipalities with flood adaptation policies was that they had already experienced extreme events. This research further highlighted that a more proactive adaptation process could be facilitated by multi-level governance frameworks [41]. Dovers and Handmer [42] add to this that policy choices made based on proactive forms of resilience would necessarily focus on “multiple and shared-source responses and multi-disciplinary and cross-sectoral work”. They however also caution about the challenges associated with such an approach due to current institutional arrangements having evolved without considering the interdependencies across the networks that form human settlements.

## 5. Conclusions

In conclusion, there are a number of concepts of resilience used for urban policy development that are characterized by different time preferences and perceptions of the urgency of addressing future challenges, among other factors. Reactive, short-term and narrow-focused resilience policies are proposed to be unsuitable to deal with the uncertainty associated with long-term urban development and therefore unsustainable. Without a proactive approach to addressing the root-cause of future challenges there is the risk of investing in dangerous trade-offs that will limit the ability of the new generation to cope with the consequences of present resilience action. The challenge is then to find an understanding of resilience that strikes an equilibrium between preventive and reactive action, while also achieving other social goals such as livability, equity and environmental sustainability. Future research should explore the practical implications and limitations of such an approach in an urban policy environment where, as discussed earlier, the incentive mechanisms are geared towards short-term, reactive policy with “ribbon-cutting” opportunities. In addition to this, research that can demonstrate what is at stake and the business case of adopting more sustainable forms of resilience for urban policy may have the potential to support a more systemic change.

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