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# Urban Sustainable Resilience Values: Driving Resilience Policy that Endures

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## Abstract

Countries across the globe are likely to face significant challenges in coming years that will test the resilience of their cities. However, there is often a lack of proactive evidence-based analysis of available options and their outcomes as well as indicators of success or progress. Without such analysis it is difficult to clearly gauge progress towards set goals, to improve effective policy development and implementation, and to create an active learning culture that can efficiently and effectively tackle future challenges. The present work offers an introduction to research being done to develop a policy evaluation and implementation framework that can help policy-makers produce more effective resilience policies which are sustainable over time. The term *sustainable resilience* has some usage in the literature but has had limited uptake and has not been formally characterised until now. This new concept creates a clear differentiation from reactive disaster resilience which is often the sole focus of urban policy development. This paper contributes to developing a working concept and guiding principles for urban sustainable resilience policy. This work suggests that sustainable resilience policy will need to take into account the complexity within and between the various systems that form cities, rapidly changing technologies, environmental conditions, and emerging forms of governance. This paper also briefly outlines the methodology that will be used to continue to develop a sustainable resilience policy framework and evidence-based assessment tool.

**Keywords:** resilience, sustainable, policy, evidence-based assessment.

# 1. Introduction

Cities currently host more than half of the world's population, a number which is projected to reach 66% by 2050 (UN, 2014). In 2014, countries such as Australia, Japan, Qatar, the Netherlands and Uruguay had less than 11% of their population living outside of urban settlements (The World Bank, 2015). Cities also generate large percentages of the national gross domestic product (GDP) and are important sources of employment. In Australia for example, 80% of GDP and 75% of employment is produced in cities (Commonwealth of Australia, 2011). 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 likely be significantly different from past experience, while also aiming to maintain and increase liveability and social well-being.

This realisation has led to a surge of resilience literature and policies for ecosystems and urban settlements. The academic literature has been particularly prolific in providing different interpretation of the term. A recent literature review for example analysed 172 resilience studies and found 25 distinct definitions of the term "resilience". Half of the definitions were centred on a specific threat and 40 percent focused on a static (single-equilibrium) view of resilience (Meerow, et al., 2016). Even within disaster focused resilience literature there is a range of definitions. Manyena (2006) for example was able to separate 12 definitions. Policies are thus guided by different understandings of resilience. Davoudi (2014) argues that many of them are in fact driving a new form of "resilient urbanism" which is focused on short-term emergency response rather than long-term adaptive capacity. These are driven by the objective of quickly returning to a state of equilibrium after being affected by sudden external shocks, such as climate events, and often pay little attention to chronic long-term stress sources. These "*high time preferences*", namely valuing the present above the future, has been argue to generate a perception of time which is incompatible with cycles that shape civilisation. Further to this, Moffat (2014) argues that this short-term vision devalues the key idea of resilience and that "*until time preferences change, progress towards resilience will be very slow, regardless of changes to public policy or technical expertise*". The concepts of *sustainable resilience* and *sustainably resilient policy* aim to challenge this trend and bring the focus of the debate towards how to deliver urban policies that can be proactive in creating enduring resilience and prompting sustained action.

The present work explores and outlines the concept of sustainable resilience, which has usage in literature but has received marginal application, particularly when compared to concepts such as socio-ecological resilience. It is argued here that the concept of sustainable resilience requires a more solid foundation in the resilience literature. This approach creates a clear differentiation from reactive conceptualisations of resilience that have a short-term narrow focus. This paper also proposes that cities not only require policies that encourage resilience which is sustainable over time or enduring, but also require policies that themselves are sustainably resilient. The following sections therefore explore policy implications of using this concept and introduce the ongoing research being carried out to develop a sustainable resilience policy framework and assessment tool.

## **2. Research Methodology**

This paper presents the early findings from a research project that aims to develop a sustainable resilience policy evaluation and implementation framework. The following sections outline the working concept and draft guiding values or principles resulting from an initial literature review. These are now being tested through a systematic literature review. The detailed methodology and outcomes of this ongoing research will be later published through a journal article.

The initial literature review was based on a thematic analysis of published *personalised* resilience concepts. These are definitions that, although they might be based on mainstream concepts, have been expanded to include a more comprehensive set of characteristics based on a focus on urban/community planning and management. The working hypothesis is that a large portion of these emerging resilience concepts are guided in part by sustainability values, either explicitly or implicitly. In some cases, the authors do not completely outline a new concept but argue for changes in the way resilience is defined in order to become more sustainable over time (see for example Meerow, et al. (2016)). The concept of sustainable resilience has also been used in the literature (see section 3) but has yet to be defined. This paper aims to provide a characterisation of this concept, including a working definition with a focus on urban policy implications.

The inclusion criteria for the thematic literature review is: academic and policy papers and book chapters discussing resilience policy, sustainability thinking, resilience thinking, sustainable resilience, proactive resilience, urban policy for complex problems and multi-actor networks, and climate change policy; papers published in English; and papers published since 1970. This initial literature review included 93 references.

Within the context of this research, policies are understood as the positions taken and articulated by government and other organisations that recognise a problem and state, in general terms, the actions to be taken to address the problem (Dovers, 2005). These are composed of a set of objectives, targets, instruments and agents (Vogel & Henstra, 2015).

## **3. Sustainable Resilience: A Concept to Bring them All and Bind them**

The word resilience has existed in the English language for a couple of centuries and has evolved into a number of types of resilience applied to different scopes and used for policy development worldwide (Alexander, 2013). Different resilience concepts have significantly different policy implications. “Bouncing back” or equilibrium-based concepts tend to generate policies that focus solely on recovery and often underestimate the difficulties of managing complex and highly adaptive systems such as cities (Fiksel, 2006; Davoudi, et al., 2012). By focusing only on recovery from and vulnerability to acute unexpected disturbances, such as earthquakes and floods, policies may be limiting the impact of the initiatives they encompass and the long-term resilience of the cities they apply to.

The terms *urban resilience* and *sustainability* are closely related and, in more recent times, increasingly used interchangeably (van der Heijden, 2014). The links between sustainability and resilience have also been highlighted by a number of authors over the last 20 years (Ahern, 2011; Fiksel, 2006; Fiksel, 2003; Perrings, 2006; Arrow, et al., 1995). These however often focus on the use of resilience principles to achieve environmental sustainability.

The term *sustainable resilience*, on the other hand, has been used in some publications (Steiner, et al., 2007; Steiner, et al., 2006; Vogel, et al., 2007; Bonstrom & Corotis, 2012; Afgan & Veziroglu, 2012). There are also a number of publications that advocate integrating sustainability principles with resilience thinking, such as Angeon and Bates (2015). Nevertheless, the concept itself, clearly outlining the characteristics of a type of resilience which is sustainable over time or enduring, has not been fully developed in the literature.

The relatively low uptake and development of this concept may be related to two facts. On the one hand, some proponents see sustainability and resilience as interchangeable concepts voiding the need, in their view, to define a form of resilience which is sustainable. However, although complementary the two terms can lead to significantly different policy outcomes; some sustainability policies may not increase the resilience of cities and some resilience policies may be unsustainable. On the other hand, the term sustainability is often highlighted as ambiguous as well as having charged ethical (Fiksel, 2003) and political undertones (Dovers, 2005). However, we propose that formalising the concept of sustainable resilience which is already emerging can help improve policy development and leverage decades of scientific literature already available. The following sections propose a working concept and guiding values based on sustainability thinking applied to urban resilience policy.

### **3.1 Sustainability as an Approach to Resilience**

Sustainability as an approach can be applied to a number of goals as an overarching guide. It requires taking into consideration the dynamic interactions and behaviours of complex self-organising systems to support coordinated action to address challenges in the context of uncertainty and incomplete information (Ahern, 2011). A sustainability approach also encourages a long-term vision leading to preventive and proactive attitudes. Lederach (1997) for example used the term *sustainable reconciliation* in his book about conflict resolution emphasising that this goal requires a long-term, integrated, inclusive and holistic view of the issues and objectives. The following four overarching values or principles are dominant in the urban sustainability literature and much of the more recent resilience literature.

- Adaptive/dynamic capacity: Although these words may not always be explicitly used, literature about sustainable development and resource management often deals with practices and processes related to adaptation and dynamic systems (Smit & Wandel, 2006; Fiksel, 2006). In this sense, it refers to the capacity of systems to dynamically adapt to changing challenges and opportunities in order to better cope with and manage them (Smit & Wandel, 2006).

- **Sustained/persistent:** At the core of most definitions of sustainability is the ability to sustain human and ecological systems. The way in which this may be done and measured is open for debate, but the ultimate objective is to allow systems to continue to function and persist into the future (Gale & Cordray, 1994).
- **Preventive/proactive:** Another core characteristic of strong sustainability is its focus on long-term futures (which are inherently uncertain) in order to ensure the survival of future generations (Brown, et al., 1987; Dedeurwaerdere, 2014). This is sometimes referred to as the precautionary principle in environmental sustainability management (Dovers, 1995).
- **Holistic/quadruple bottom line:** Sustainability science and policy typically deal with balancing goals of various stakeholders and aiming to identify potential conflicts (Dedeurwaerdere, 2014). The idea of the quadruple bottom line provides a holistic approach where urban sustainability resides in the interaction of four drivers: economic development, social development, environmental protection and effective governance. Within the present context, the latter refers to the institutional capacity of the urban system (Teriman, et al., 2009).

These values have also been highlighted as requirements for long-term sustained resilience. Adger, et al (2011) for example write about resilience highlighting the relationship between adaptive capacity and the confluence of economic development, technology, human capital and governance structures.

### 3.2 Sustainable Resilience Network Values

The above overarching values from sustainability thinking were used to map specific network values that are highlighted in the literature as underpinning forms of resilience which can be sustained in the long term. The following recur throughout this literature.

- **Dynamic:** A complex systems view of cities is required in order to understand and cope with cascading effects of stress events (McIlwain, et al., 2013). Characteristics of complex dynamic systems often mentioned include: non-linearity, uncertainty, emergence (sometimes described in terms of surprise), scale and self-organisation (Berkes, et al., 2003; Damper, 2000). A dynamic view of the urban system emphasises the constant state of flux and change as well as the uncertainty surrounding future stress sources (Folke, et al., 2002).
- **Socio-eco-technical interactions:** The fact that cities can be seen as socio-ecological systems is hardly debated since the rise of socio-ecological resilience. These socio-ecological interactions create the opportunity for technological progress (Folke, et al., 2002). In turn, technology can be used as a tool to enhance the resilience of cities (Fiksel, 2003). Technological progress has also been acknowledged as providing both new challenges and opportunities for urban resilience (Smith & Stirling, 2010). However, information technologies are evolving into socio-technical systems and slowly becoming integral to every aspect of urban asset management and governance. Therefore, sustainably resilient systems also include dynamic technological change and socio-

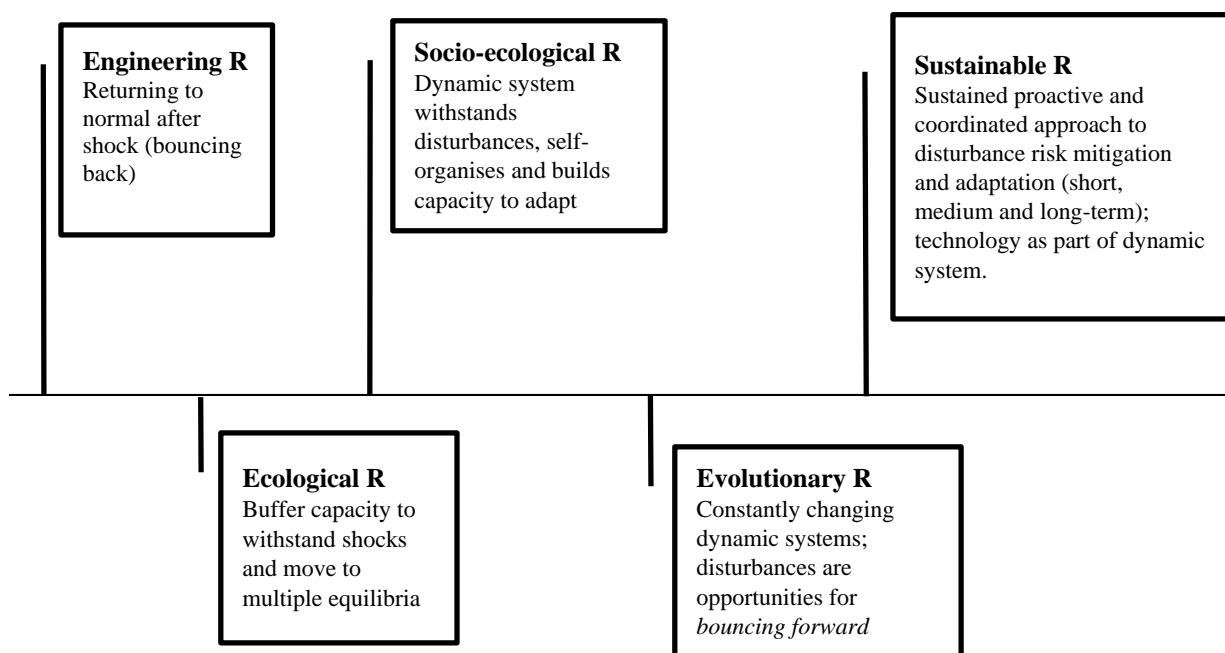
ecological as well as emerging socio-technical system interactions as part of the environmental context.

- Sensitive and adaptive: There is a need to make management and governance systems adaptive and flexible in order to be able to deal with uncertainty. This approach emphasises an ongoing and active learning capacity which is sensitive to feedback from the system components and environment, including the community context (Berkes, et al., 2003; McIlwain, et al., 2013). The Rockefeller Foundation for example talks about reflective and resourceful systems referring to the ability to learn and change behaviours in response to changes (100 Resilient Cities, 2015). Jabareen (2013) further argues that urban resilience in the face of climate change requires uncertainty-oriented planning policies so the system can cope with statistical uncertainty and a continuous range of conditions. Labaka et al. (2015) additionally highlight the need for ongoing data acquisition, monitoring and evaluation in order to maintain the sensitivity of the systems to current conditions.
- Coordinated and cohesive: Cities are formed by systems of networks that function based on their connectivity in order to increase cohesiveness and coordination (Ahern, 2011). Here cohesion refers to the existence of linkages across system components (Fiksel, 2003) and coordination relates to more effective multi-scale network functions (Ahern, 2011). Horizontal and vertical coordination across the components of the systems are necessary for it to function as a whole while maximising its adaptability. This should include feedback loops between and across the components and governance systems (McIlwain, et al., 2013). This for example refers to coordination across infrastructure network governing bodies as well as across political governance levels such as councils and state organisations in order to achieve a cohesive system.
- Capacity to persist: This characteristic is related to having a proactive approach to risk mitigation and abating at different time-scales. It is about reducing the likelihood of stress events occurring and affecting the system in the short, medium and long-term. In the short-term it refers to being able to withstand both acute shock events and chronic stress due to the robustness of the systems, existence of redundancies and flexibility in the face of changing conditions (McIlwain, et al., 2013; 100 Resilient Cities, 2015). In the medium-term it takes in part from evolutionary resilience in that stress events are opportunities to “*bounce forward*”; that is to move away from simple recovery and towards renewal to improve the resilience of the city and the community (McIlwain, et al., 2013). In the long-term is about prevention of future sources of stress, this includes for example climate change mitigation initiatives (Jabareen, 2013). Although having a different understanding of resilience, Register (2014) argues “*if we start thinking in really basic terms, we may realize that the city that is best for adaptation adapts least – because... it doesn’t have to*”. Register also argues against seeking to adapt to changes while ignoring the root cause, principles and likely futures. Truly sustainable resilience policy should address short, medium and long-term time scales.
- Embraces diversity: This relates to the existence of redundancies and promotion of modularisation to spread risk across time, geographic and system scales. This is for example provided by distributed and decentralised systems (Ahern, 2011). Diversity of redundant components means that the system has back-up structures and does not depend

on a single component. Systems are made of sub-systems which are relatively independent of but provide support to and complement each other (McIlwain, et al., 2013). It encourages multiple forms and behaviours in order to create inherent resilience across the whole system (Fiksel, 2003; 2006).

- **Efficient:** It refers to the efficient use of capital and resources through multi-functionality. It supports response diversity within single functions while being able to perform more than one function either simultaneously or progressively (Ahern, 2011). This characteristic can be complementary to diversity where one component can create redundancies by performing multiple functions to maximise the efficiency of the resource investment (Ahern, 2011). It is also closely related to the capacity to persist in that by using resources more efficiently, there is less resources needed and less risk of loss as well as less demand. This can potentially also reduce long-term risks (Fiksel, 2003; Register, 2014). It requires a clear understanding of the system needs, limits and opportunities for synergies across system components.

### 3.3 Sustainable Resilience Concept



*Figure 1 Characteristics of some common concepts compared to Sustainable Resilience*

From the above discussion it follows that dominant concepts of resilience may be insufficient for the development of more comprehensive resilience policy which can be sustained over the long term. The lack of mainstream concepts that openly include sustainability principles may be a result of perception biases, either because authors use the terms interchangeably or because they consider the term “sustainability” too loosely applied, vague or semantically charged (van der Heijden, 2014). Whatever the case, there are good reasons to bring core sustainability aspects to our thinking of resilience in order to improve the effectiveness of urban policy. This is reflected by (although not always explicitly) academics and policy-makers proposing new conceptualisations of resilience that expand the defining characteristics based largely on



sustainability principles. These new conceptualisations may be summarised through the following working definition, referred from here on as urban sustainable resilience:

Urban sustainable resilience is the capacity of socio-eco-technological complex dynamic urban systems to tolerate disturbances, which can be chronic or acute, and persist in a sustained manner through ongoing learning and adapting to changes to the environment and the needs of the system. It requires efficient, diverse, coordinated and cohesive strategies that proactively address short, medium and long-term challenges. Urban sustainable resilience is underpinned by sustainability and dynamic system resilience principles in order to define practical policy aspects that allow cities to tolerate disturbances, evolve with the changing environment (where environment refers to climate, social sentiment and technological context) and mitigate future sources of stress.

Figure 1 briefly outlines some of the different policy implications for some more common resilience concepts and the proposed sustainable resilience concept.

## 4. Urban Sustainably Resilient Policy Qualities

*“Urban policies are critical in making cities more resilient and are crucial factors in bringing the governance of global environmental problems to urban contexts”* (Jabareen, 2013). However, from an offer and demand point of view, policy-makers struggle to offer policies that address long-term resilience challenges and citizens often do not provide a sustained demand for policy interventions. This is in part due to the short election cycles and people often failing to understand the urgency of having a long-term vision. This leads policy-makers to take advantage of windows of opportunity when disaster strikes to introduce resilience policies (Vogel & Henstra, 2015). The constantly changing political, economic and social environment also prompts short-term interventions rather than sustained action (Broniatowski & Weigel, 2008). However, resilience as conceived here, requires continual action incompatible with constantly changing policies. In addition to urban policies’ goals, targets, instruments and agents striving to create more sustainably resilient urban systems, it is therefore hypothesised that the policies themselves can have sustainable resilience qualities in order to ensure sustained outcomes. Under this hypothesis policies themselves should show the seven values outlined in the previous section. After exploring the implications of this proposition (to be published at a later date), the following policy qualities are suggested to form the policy development guiding principles.

- **Political resilience:** The political environment has a clear impact on the choice of policies and the time-scale of their objectives and implementation. Short-term political cycles commonly translate into short-term goals and policies but to achieve sustainable resilience of urban systems a long-term strategy is also required. *“A system designed under these circumstances must be able to deliver value under a constantly shifting political environment... These systems must therefore have an architecture that allows for political sustainability”* (Broniatowski & Weigel, 2008). Political resilience means that policies need to be designed to withstand changes in government within and across levels of governance. This is closely related to policy goals, values and interests, and although it depends on the perception of delivered value, this is not a sufficient condition

(Broniatowski & Weigel, 2008). Multi-level governance perspectives can leverage on opportunities and identify contradictions that arise from the interpretation of challenges that apply to different scales and spheres of governance and authority (Bulkeley & Betsill, 2005). Promoting a resilience-based culture across stakeholder groups can also help improve coordination and communication, and lead to more politically resilient policies (Labaka, et al., 2015). Political resilience also relates to the way issues are framed and perceived by policy-makers (Vogel & Henstra, 2015). Sustainable resilience policies should be framed in such a way that urgency that springs to action is conveyed without politicising the issues. This can help reduce the risk of changes in the government's political views affecting the objective assessment of policy outcomes. In the long-term, policy-makers should aim to integrate successful aspects of implemented policies into the overarching values that guide the evaluation and implementation of subsequent policies and laws; including across other policy fields. *“To be robust and durable over time, adaptation principles and objectives must be integrated into day-to-day planning and decision-making processes”* (Vogel & Henstra, 2015).

- Economic resilience: Political will, the collective willingness to do something, is critical to successful policy implementation but may waver depending on a number of aspects (Vogel & Henstra, 2015). Funding of any policy is commonly closely tied to political will. This often leads to funding short-term programs with ribbon-cutting opportunities at the expense of long-term cost (Herrmann, et al., 2009). Setting resilience priority areas and cost-benefit analysis can help deal with limited funding for capital investment. However, designing policies that encourage infrastructure that has more than one function while increasing urban resilience and providing potential financial gains can support political resilience by providing economic resilience (McIlwain, et al., 2013). Policies should take into account the financial sustainability of the initiatives but also be able to absorb additional cost brought by evolving challenges as they arise (Labaka, et al., 2015). Economic resilience could entitle transforming sunk costs into returns on investment (ROI) by leveraging inter-governance synergies (e.g. integrating urban waste treatment, district heating/cooling and industrial waste heat disposal). Assessing commercial co-benefits and partnering with industry for long-term financing of resilience initiatives as well as coordinating budgets across governance boundaries can also help achieve this (McIlwain, et al., 2013).
- Social resilience: Stakeholder support commonly influences policy choices and actively addressing stakeholder concerns can help avoid implementation failure (Vogel & Henstra, 2015). Resilience policies should include *“adaptable social infrastructure to assure meaningful participation”* (Ahern, 2011) in order to maintain sensitivity to the constantly changing needs and interests of the system. Additionally, for policy to be sustainably resilient in the face of constant change it is suggested that it needs to be able to steer or adapt to changes in social sentiment (general priorities and views of the local public). Achieving this may require integrating deliberative democracy processes which have been proposed as a way of delivering long-term transformational policy objectives (Hartz-Karp, et al., 2013). Progress towards higher levels of resilience often also requires social uptake of new behaviours (McIlwain, et al., 2013). Long-term policy effectiveness and social support requires active engagement with stakeholders and brokering

knowledge in a way that the community can be receptive to it. This could mean integrating educational programs or gaining insight into how decisions are made by individuals in order to frame policy actions appropriately (Shediac-Rizkallah & Bone, 1998). The growing fields of opinion mining and sentiment analysis may also be of use (Pang & Lee, 2008).

- Environmental or contextual resilience: A network value of sustainably resilient systems is proposed to be that their environment is formed by its socio-ecological components as well as by technology. The latter is often a key part of urban resilience policy actions and frequently changes at a higher pace than the built environment and models used to design the policy in the first place (McIlwain, et al., 2013). Action plans and strategies resulting from resilience policy need to be able to remain sensitive and adapt to changes in the ecological and technological environment in order to stay effective over time. The understanding of the policy priorities and what forms, for example, critical infrastructure may also change over time (McIlwain, et al., 2013). This means that resilience policy programs should include active learning and monitoring processes that encourage frequent and comprehensive reviews of the needs and opportunities provided by the changing environment.

## 5. Future Research

This work is part of a three-year project. Future research will continue a systematic literature review of academic and government documents related to urban resilience and policy. This effort will meticulously map the characteristics of emerging concepts of urban resilience which are framed as more sustainable over time; following sustainability principles explicitly or implicitly. This will be used to complete the working concept and draft framework which will be tested through expert consultation that includes academic, government and industry professionals. The revised version will be further developed into an evaluation framework consisting of specific indicators for urban sustainable resilience policy assessment. This will be tested through a series of international case studies that will also include policy content and processes analyses. This research will aim to deliver three main practical outcomes: (i) best practices based on success factors of sustainable resilience policy from international case studies; (ii) a set of comparators/indicators that allow evaluating these types of policies across city and state borders; and (iii) a practical tool for policy-makers for evaluation and implementation of more effective and sustainable urban resilience policies.

## 6. Conclusions

This publication briefly explores the relationship between resilience concepts and urban policy as well as suggest a working concept for the term *sustainable resilience*. This is done by drawing from emerging resilience concepts which are implicitly or explicitly driven by sustainability principles. The authors also introduce a set of urban sustainable resilience values and policy principles. Future research will continue a systematic literature review to increase the robustness of the proposed concept and framework as well as continue developing them. The resulting framework will be tested and validated through further research.

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