Part I

Critical review from different disciplinary perspectives

Urban resilience and urban sustainability

Christian Kuhlicke, Sigrun Kabisch, and Dieter Rink

Introduction

This chapter delivers an overview on definitions of and the distinction between urban resilience and urban sustainability. In the first part, we offer the reader a short description of the origins as well as key understandings of resilience and sustainability in order to open up a comparative assessment of both concepts.

Based on this, in the second part we draw attention to the specific urban perspectives on both terms. Using the four topics of instabilities and disturbances, distribution of responsibility, normative orientation, and space–time dimension, we discuss commonalities and differences.

In the third part, we offer some critical reflection of how both concepts are utilized in scientific and in more operational urban contexts.

Conceptual foundation of resilience and sustainability

Resilience

The term "resilience" comes from the Latin *resilire*, *resilio* (Alexander 2013; Manyena *et al.* 2011); it passed into Middle French (*résiler*) and then into English, during the sixteenth century, as the verb "resile". According to Alexander, the word looks back on a "long history of multiple, interconnected meanings in art, literature, law, science and engineering. Some of the uses invoked a positive outcome or state of being, while others invoked a negative one. Before the 20th century, the core meaning was 'to bounce back'" (Alexander 2013, 2710). This notion dominates in different academic disciplines such as physics, textile and material science, as well as engineering sciences or psychology (de Bruijne *et al.* 2010; for an overview, see Mykhnenko 2016).

A further conceptual approach was introduced by Holling (1973) in his influential publication "Resilience and stability of ecological systems". He rejected the idea of restricting resilience primarily to the ability of ecosystems to bounce back to a pre-disturbance state. Instead, Holling proposed to distinguish resilience more clearly from stability. In his view, resilience would be a much more appropriate concept for understanding and managing the dynamics of ecosystems, since such systems are defined by multiple states of stability (Holling 1978). Holling,

therefore, attempted to integrate three separate stability properties under the unifying umbrella term "resilience": recovery (return to the status quo after disturbance), resistance (buffering the impact of a disturbance), and persistence (staying intact as an identifiable object/subject over time) (Grimm and Wissel 1997).

Another approach to resilience was developed with the analysis of the interaction of social and ecological systems (Brand and Jax 2007; de Bruijne *et al.* 2010) by including aspects of adaptability, learning, and transformation. In this reading, the idea of bouncing back has been increasingly replaced by the metaphor of "bouncing forward"; an idea that is regarded as more appropriate since it acknowledges the interplay of disturbances and reorganization, as well as long-term societal adaptation processes (Romero-Lancao *et al.* 2016, 5).

Whereas resilience was, for a long time, primarily a concept utilized in the academic community, in more recent years it has also been taken into account on the policy level, in order to make infrastructures, institutions, and communities more resilient. It is often argued that the increasing relevance of the concept results from a deep-seated feeling of exposure and vulnerability resulting from "environmental change, threats to national and international security, and an array of issues associated with international migration and growing global economic turbulences" (Mykhnenko 2016, 176). A prominent example is the UN International Strategy for Disaster Reduction (UN-ISDR) campaign, "Making Cities Resilient", which was launched in 2010 (Molin Valdés *et al.* 2013). This campaign provided a checklist containing principles that local governments should consider for building resilience. Subsequently, at the World Urban Forum in Naples in 2012, UN-ISDR and UN-HABITAT jointly promoted disaster-resilient cities. Complementing international activities at national and sub-national levels, attempts have been introduced to make the concept of resilience more policy-relevant and to include it on the operational level in disaster risk management, infrastructure planning, as well as urban development (for an overview, see Weichselgartner and Kelman 2014).

Sustainability

The term "sustain" is of Latin origin. In a Latin dictionary from 1879, the verb *sustinere* was translated as "sustain" or "maintain". The *Oxford English Dictionary* dates the word "sustain" back to the Middle English period (1150–1350), and it encompasses a group of meanings: "to keep in being", "to cause to continue in a certain state", "to keep or maintain at the proper level of standard", and "to preserve the status of" (Grober 2012, 19). At the beginning of the eighteenth century, the Saxonian forest governor, Carlowitz, introduced the concept of sustainability into forestry with the connotation that no more wood should be felled than grows back (Grober 2012, 81 ff.). In the following centuries, sustainability became a key principle in forestry. At its core, it emphasizes the restriction of resource use to a level that guarantees a continuous resource reuse for current and future human generations.

Not surprisingly, the results of a literature search in the Web of Science reveal that the term "sustainability" appeared for the first time in an article about forestry science (Mykhnenko 2016, 183). However, its prominence goes back to the United Nations (UN) and when it formulated the principles of sustainable development as a global political statement and leitmotif in the late 1980s. The UN World Commission on Environment and Development defined sustainable development as development "that meets the needs of the present generation without compromising the ability of future generations to meet their own needs", in its report "Our Common Future" (WCED 1987, 41). WCED has also stressed that "sustainable development must not endanger the natural systems that maintain life on earth" (WCED 1987, 46). Sustainability represents the attempt to develop a concept for the long-term protection of natural resources, the long-term

satisfaction of social needs, and the long-term conservation of economic resources. Thus, it goes beyond traditional ideas of environmental protection and nature conservation, which focus above all on natural resources; it rather demands for intergenerational and intragenerational justice on a global scale. It is important to note that sustainability, in this sense, is first and foremost a normative political expression. However, its wording, understanding, and definition have been adopted by various scientific disciplines without critically engaging with its normative political underpinning.

Sustainability was implemented subsequently also on the local level. At the 1992 UN Summit on Environment and Development in Rio de Janeiro, more than 170 countries committed themselves to the idea of sustainable development, including greening the economy and society and calling for greater equality of opportunity within and between societies (UN 1992). Since the 1992 UN Summit, sustainability has become a central, perhaps even the decisive, narrative for decision-making processes in different spheres (e.g. political, economic, environmental). The direct appeal to municipalities to consult with their citizens on ways to achieve more sustainable urban development within the so-called "Local Agenda 21" also transferred the political sustainability concept to the urban context (ICLEI 2012).

Urban resilience and urban sustainability: Commonalities and differences

Initial thoughts about the interrelation of resilience and sustainability are provided by Handmer and Dovers (1996) as well as by Tobin (1999). In more recent years, a series of publications aimed at unravelling commonalities and differences between both concepts. Studies highlight, amongst other aspects, the variety of strategies for dealing with unexpected dynamics and disturbances in urban contexts (Ahern, 2011): they provide reflections about whether resilience complements sustainability (and/or vice versa) or whether they are two separate objectives in environmental management (Marchese *et al.* 2018) and in urban development respectively (Asprone and Manfredi 2015; Romero-Lankao *et al.* 2016; Zhang and Li 2018).

It is apparent that both concepts are open to multiple, sometimes even contradictory interpretation, which we conceive, on the one hand, as their strength, because they stimulate exchange and conversation among different disciplines. At the same time, their definitional openness requires an increased communicative effort to prevent misunderstanding and confusion. Based on our own research on natural hazards and social resilience (Begg *et al.* 2017; Kuhlicke 2019), as well as on urban transformations and urban sustainability (Rink and Kabisch 2017, Kabisch *et al.* 2018), we propose a more thorough scrutiny of some of the wider implications both concepts might have for future urban development. Thus, we structure the discussion along four key topics we consider as being relevant for achieving a clearer distinction between both concepts: (1) instability, disturbances and a shifting framing of urban safety; (2) a shifting distribution of responsibility between public and private actors; (3) the normative basis of both concepts; (4) as well as their implicit space–time dimension.

Instability, disturbances and a shifting framing of urban safety

Both resilience and sustainability are underpinned by a strong concern about disturbances and potentially unstable future developments. However, with respect to the role attributed to disturbances, the conclusions drawn about their potential occurrence, as well as the relevance of such disturbances for urban development, both concepts differ quite profoundly.

The actual emergence of the concept of urban resilience is often connected to the experience of unexpected devastating events, such as 9/11 and the collapse of the World Trade Center, hurricane Katrina and the devastation of parts of New Orleans, terrorist attacks in Madrid,

19

London, etc. But urban resilience has also attracted considerable attention as a result of other symptoms of crises. These include the financial crisis in 2007/2008 and its repercussions for cities' budgets, as well as rapid urban changes (e.g. population shrinkage and re-growth) and their enormous impacts on the urban infrastructure. Most definitions of urban resilience therefore offer suggestions about how to enhance the "generic adaptability, flexibility, or adaptive capacity" of urban areas (Meerow *et al.* 2016, 44).

The role that disturbances play in the conceptualization of sustainable urban development is less obvious. Some researchers even argue that resilience is superior to sustainability, because the latter would be based on a "static conception" shaped by the idea of a "durable, stable, […] fail-safe" urban development and, hence, would be blind towards urban crises and radical changes (Ahern 2011, 341). However, a closer reading reveals that the concept of sustainability is linked to potential disturbances in at least two different ways. First, it is based on the assumption that strong efforts are not only necessary; they are essential to prevent future devastating disturbances. Because natural resources are limited and not simply reproducible, such limits need to be taken into account. If they are ignored, the consequences for future generations are potentially devastating as the natural environment is irreparably destroyed. This is also reflected in what one might label the "urban turn" of the sustainability debate. This is an attempt to solve global problems – particularly mitigation of climate change – on the local level by, for instance, advancing the idea of a post-fossil city (i.e. the complete conversion of the energy basis to regenerative carriers). Second, urban areas themselves should develop in ways that do not merely reflect environmental concerns, but also consider the social and economic dimension. Particularly with regard to social sustainability in an urban context, access to resources and inclusiveness, but also social security, are considered to be decisive components of urban sustainability (Barton 2000; Dempsey *et al.* 2011). This includes the postulate to be able to live in an urban environment that is safe and secure.

The concept of resilience implies a different understanding of how to make urban areas secure. It accepts dynamics and the occurrences of radical surprises (Evans 2011) and demands anticipating and preparing for them. The aim is to contain and mitigate surprises by no longer assuming that urban environments are "fail-safe", but rather to develop procedures that follow a "safe-to-fail" strategy (Ahern 2011, 341). The concept of resilience thus accepts potential disturbances and catastrophic events as inevitable and, consequently, pleads in favor of preparing for such events as well as for learning relevant lessons, in order to reduce the respective consequences. These general characteristics are translated into more specific features of urban resilience; these include robustness, redundancy, diversity, equity, decentralization, flexibility, adaptive capacity, and predictability of failure (Meerow *et al.* 2016; Ahern 2011). This also encompasses the view that catastrophes can no longer simply be considered as negative events that are associated with loss, damages, and trauma. They can also be seen as a "window of opportunity" to initiate transformations towards a less vulnerable and, thus, more sustainable development. According to this reading, to be resilient even becomes a pre-condition for sustainable urban development (Romero-Lancao 2016).

In this view, the move from urban sustainability towards urban resilience is based on a shifting understanding of urban security, as well as of the risks urban areas are facing. By highlighting the idea of resilience, risks are no longer easy to detect before they occur, and they are no longer easy to contain. On the contrary, they can occur everywhere and always, potentially with cascading effects. The attractiveness of the idea of making urban areas more resilient is thus grounded in the underlying premise that the concept offers an answer to urban threats by going beyond established approaches to control, secure, and, in the final sense, on how to govern urban areas (Pospisil 2013).

Distribution of responsibility between public and private actors

With regard to the underlying distribution of responsibility, both concepts are distinctly different. The concept of resilience tends to dissolve clear responsibilities, whilst the concept of sustainability is clearly highlighting the relevance of public actors such as international institutions, states, or municipalities. Consequently, some critics of the resilience approach have linked its supposed ascendance with the perceived desire of Western governments, international financial institutions, and bilateral donors to respond to such serious challenges by shifting the burden of responsibility onto individual citizens and local communities (Mykhnenko 2016).

In resilience-based governance settings, governmental bodies and administrations tend to devolve responsibility to local actors, including citizens, by communicating the limits of their ability to protect citizens and, as a result, make citizens individually and "morally" responsible for future disturbances and risks (Begg *et al.* 2016). The role of public authorities is usually restricted to an enabling and supporting one and, specifically, not to a funding or legally regulating one. As a result, individuals and communities need to organize themselves, in order to become more resilient (Welsh 2014).

With respect to sustainability, the global community and the national states bear responsibility. The "Sustainable Development Goals" (SDGs) (UN 2015) are good examples of challenges to secure natural resources and livelihood globally. As a political expression of complex challenges, the document needs translation into real-world contexts by politicians, NGOs, regional entities, and other stakeholders. Sustainability acts as a framework for prioritized aims of human co-existence. Against this background, the recent adoption of the "New Urban Agenda", including the 17 SDGs (UN 2016), gives substance to the obligation to pursue sustainability in core sectors of human life. Cities and urban areas play a key role, which is formulated in SDG No. 11: "Make cities and human settlements inclusive, safe, resilient and sustainable". This goal can be considered as a node for numerous other SDGs and sub-targets because it unites global challenges on the urban and immediate human scale.

Normative basis of both concepts

We understand both resilience and sustainability as normative concepts. Nevertheless, they differ in their degree of explicitness about their normative underpinnings: Whilst sustainability explicitly reveals its strong, normative expression, the normativity of resilience is more opaque.

Resilience is often positioned as a "neutral" or more "strategic" (Ahern 2011, 342) concept, which is, at least in the view of some authors, not normative. This is considered as advantageous, because resilience offers some principles that appear to be more or less naturally given and with which existing planning and management approaches can be evaluated (fit for purpose) and adapted or transformed. From this perspective, however, the task of making cities more resilient is, above all, a simple managerial task that requires adapting the organizational–institutional design of existing planning approaches (Cannon and Müller-Mahn 2010).

Critics argue that such a perspective would lead to a depoliticization of highly relevant societal questions, since resilience is neither a fixed concept nor is it simply a given idea (Kuhlicke 2019). The question about how to organize a resilient city or how resilient an urban area should be is intimately connected with normative questions, which can be answered very differently by different groups. The answer to questions such as which degree of resilience is relevant or which level of resilience is acceptable does not stem from ecological principles, but, instead, depends on how urban life should be organized in the face of potential disturbances, strong dynamics, and respective decision-making processes (Cote and Nightingale 2012).

21

The concept of resilience, again, is less broad spatially. It is, rather, a place-based and, thus, location-specific concept, which is less concerned about inter- or even trans-local connectivity. It aims at increasing the capacity of specific locations, communities, neighborhoods, or cities to adapt to, cope with, and learn from disturbances. Nevertheless, these learning effects can be distributed to other places facing similar risks.

Conclusions

Urban resilience and urban sustainability have become decisive notions providing orientation on how to deal with major societal challenges. This includes provision of safe and livable habitats, which should develop in a way that is based on the excessive use of scarce environmental resources. Both concepts are often mentioned in close connection and sometimes even inter-changeably. However, as both terms seem to become more and more interchangeable, the risk of losing conceptual clarity grows. The emerging debate on whether both concepts complement each other and which concept is superior is an attempt to bring some clarity to the debate. However, we argue it makes more sense to draw attention to key characteristics of both concepts, how they conform and where they differ.

More specifically, we structured our argument, firstly, around the role that is attributed to instabilities and disturbances. Here, the concept of resilience places greater emphasis on the very occurrence of disturbing events and how to adapt, cope with, and recover from them. Sustainability, on the other hand, focuses more on the "root causes" of future disturbance by emphasizing climate mitigation (e.g. post-fossil city) and, at the same time, the idea of social safety. Thus, urban residents should have the right to feel safe in their neighborhood and such safety standards should be provided equally. Secondly, as a consequence of the previous argu-ment, the distribution of responsibility is governed quite differently. Whilst it is often argued that resilience would allow authorities to assign responsibility to the individual and local level, sus-tainability demands, instead, an egalitarian approach that highlights the right of most vulnerable groups to be protected. Thirdly, both concepts are quite different with regard to their normative underpinning. Sustainability is based on the normative postulate of justice between generations and social groups. By contrast, becoming more resilient is often understood as a more neutral endeavor that depends mostly on guidance from some general principles derived from ecology (flexibility, adaptability, etc.), and, to a lesser extent, a task that is based on political and wider societal decisions (i.e. how much resilience is enough resilience?). Fourthly, and finally, both concepts differ with regard to their space–time dimension. Whereas resilience is more location-oriented and not very specific with regard to its temporal orientation, sustainability has a long-term trajectory and a global orientation.

By providing these specifications, we hope to contribute to the conceptual debate. In this sense, we place attention on the existing terminological imbroglio by stressing the particular foci, as well as the commonalities and differences of both concepts. We are convinced that pursuing such a conceptual debate will lead to an increase of the explanatory power of urban resilience and urban sustainability.

References

Ahern, J. (2011). From fail-safe to safe-to-fail: Sustainability and resilience in the new urban world. Landscape and Urban Planning. 100: 341–343.

Alexander, D.E. (2013). Resilience and disaster risk reduction: An etymological journey. Nat. Hazards Earth Syst. Sci. 13: 2707–2716.

Anderson, B. (2010). Preemption, precaution, preparedness: Anticipatory action and future geographies. Progress in Human Geography. 34: 777–789.

Asprone, D. and Manfredi, G. (2015). Linking disaster resilience and urban sustainability: a glocal approach for future cities. Disasters. 39: 96–111.

Barton, H. (2000). Conflicting perceptions of neighborhood. In: H. Barton (ed.): Sustainable Communities: The Potential for Eco–Neighborhoods. London: Earthscan, 3–18.

Begg, C., Ueberham, M., Masson, T., and Kuhlicke, C. (2017). Interactions between citizen responsibilization, flood experience and household resilience: insights from the 2013 flood in Germany. International Journal of Water Resources Development. 33: 591–608.

Brand, F.S. and Jax, K. (2007). Focusing the meaning(s) of resilience: resilience as a descriptive concept and a boundary object. Ecology and Society. 12(1).

Cannon, T. and Müller-Mahn, D. (2010). Vulnerability, resilience and development discourses in context of climate change. Natural hazards. 55(3): 621–635.

Cote, M. and Nightingale, A.J. (2012). Resilience thinking meets social theory. Progress in Human Geography. 36(4): 475–489.

Davies, W.K.D. (2015). Background to sustainable cities. In: W.K.D. Davies (ed.): Theme Cities: Solutions for Urban Problems. Dordrecht: Springer, 151–205.

de Bruijne, M., Boin, A., and Eeten, V. (2010). Resilience – exploring the concept and its meanings. In: L.K. Comfort, A. Boin, and C.C. Demchak, (eds.): Desingning Resilience: Preparing for Extreme Events. Pittsburgh: University of Pittsburgh Press, 13–32.

Dempsey, N., Bramley, G., Power, S., and Brown, C. (2011). The social dimension of sustainable development: Defining urban social sustainability. Sustainable Development. 19(5): 289–300.

Evans, J.P. (2011). Resilience, ecology and adaptation in the experimental city. Transactions of the Institute of British Geographers. 36(2): 223–237.

Grimm, V. and Wissel, C. (1997). Babel, or the ecological stability discussions: an inventory and analysis of terminology and a guide for avoiding confusion. Oecologia. 109: 323–334.

Grober, U. (2012). Sustainability: A Cultural History. Totnes: Green Books.

Grunwald, A. and Kopfmüller, J. (2006). Nachhaltigkeit. Stuttgart: Campus Verlag.

Handmer, J.W. and Dovers, S.R. (1996). A typology of resilience: rethinking institutions for sustainable development. Organization & Environment. 9: 482–511.

Hartmuth, G., Rink, D., and Huber, K. (2008). Operationalisation and contextualisation of sustainablility at the local level: Stages in the development of a sustainability indicator system. Sustainable Development. 16: 261–270.

Holling, C.S. (1973). Resilience and stability of ecological systems. Annual Review of Ecology and Systematics. 4: 1–23.

Holling, C.S. (1978). Adaptive Environmental Assessment and Management. New York: John Wiley.

ICLEI (Local Governments for Sustainability) (2012). Local Sustainability 2012. Taking Stock and Moving Forward. Global Review.

Kabisch, S., Koch, F., Gawel, E., Haase, A., Knapp, S., Krellenberg, K., Nivala, J., and Zehnsdorf, A. (eds.) (2018). Urban transformations – Sustainable urban development through resource efficiency, quality of life and resilience. Future City 10. Cham: Springer International Publishing.

Kuhlicke, C. (2019). Risk and Resilience in the Management and GovernanceProcesses, Oxford Encyclopedia of Natural Hazards Governance. Oxford: Oxford University Press. http://oxfordre.com/naturalhazardscience/view/10.1093/acrefore/9780199389407.001.0001/acrefore-9780199389407-e-299?print=pdf.

Manyena, S.B., O'Brien, G., O'Keefe, P., and Rose, J. (2011). Disaster resilience: a bounce back or bounce forward ability? Local Environment. 16: 417–424.

Marchese, D., Reynolds, E., Bates, M.E., Clark, S.S., and Linkov, I. (2018). Resilience and sustainability: Similarities and differences in environmental management applications. Science of Total Environment: 613–614: 1275–1283.

Meerow, S., Newell, J.P., and Stults, M. (2016). Defining urban resilience: A review. Landscape and Urban planning. 147: 38–49.

Molin Valdés, H., Amaratunga, D., and Haigh, R. (2013). Making cities resilient: from awareness to implementation. International Journal of Disaster Resilience in the Built Environment. 4: 5–8.

Mykhnenko, V. (2016). Resilience. A right-winger's ploy? In: Springer, S., Birch, K., and MacLeavy, J. (eds): The Handbook of Neoliberalism. London: Routledge, 190–206.

Pospisil, J. (2013). Resilienz: Die Neukonfiguration von Sicherheitspolitik im Zeitalter von Risiko. Österreichische Zeitschrift für Politikwissenschaft. 42(1): 35–42.

Rink, D. and Kabisch, S. (2017). Urbane Transformationen und die Vision nachhaltiger Stadtentwicklung. In: K.-W. Brand (ed.) Die sozial-ökologische Transformation der Welt: ein Handbuch. Frankfurt/Main: Campus, 243–266.

Romero-Lankao, P., Gnatz, D.M., Wilhelmi, O., and Hayden, M. (2016). Urban sustainability and resilience: From theory to practice. Sustainability. 8(12): 1224, 1–19.

Tobin, G.A. (1999). Sustainability and community resilience: The holy grail of hazards planning? Global Environmental Change Part B: Environmental Hazards. 1: 13–25.

UN (United Nations) (1992). United Nations Conference on Environment and Development. Agenda 21. New York.

UN (United Nations) (2015). Sustainable Development Goals. 17 Goals to transform our world. New York..

UN (United Nations) (2016). HABITAT III. The New Urban Agenda. Quito.

WCED (World Commission on Environment and Development) (1987). Our Common Future. New York.

Weichselgartner, J. and Kelman, I. (2014). Geographies of resilience: Challenges and opportunities of a descriptive concept. Progress in Human Geography. 39(3): 249–267.

Welsh, M. (2014). Resilience and responsibility: Governing uncertainty in a complex world. The Geographical Journal. 180(1), 15–26.

Zhang, X. and Li H. (2018). Urban resilience and urban sustainability: What we know and what do not know? Cities. 72: 141–148.