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OPINION

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Resilience: On-going wave or subsiding trend in flood risk research and practice?

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Abstract

Resilience in relation to flood risk management (FRM) is not a new concept, yet parts of the FRM community are still struggling to apply it. The main challenge this study addresses is the question as to whether parts of the FRM community should still adopt, or rather "leap-frog," resilience. The main purpose is to evaluate whether resilience is a still on-going trend or, already subsiding. Research suggests that resilience is an on-going trend that connects research and policy and has gained international recognition as expressed by international guidelines and bodies promoting its research but also its operationalization. Academic literature in the area of FRM also shows a significant continuing development. Resilience enables to analyze dynamics and transformations of riverine areas, or coastal zones in connection to an integrated social-environmental system approach with more emphasis and conceptual basis than previous concepts. Resilience is more than a short-lived notion and it appears that FRM researchers cannot avoid addressing it. Resilience often is a convergence of ideas and mainstreaming of efforts, which in many venues is absolutely necessary and can help, for example, to decrease silo-thinking. But as academics, we have a mandate to remain skeptical and remain on the look-out for novel ideas, too.

This article is categorized under:

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KEYWORDS

disaster risk reduction, flood defense, flood risk management, resilience, Sendai Framework

1 | INTRODUCTION

Flooding is one of the most expensive disasters and extreme hydro-meteorological events are likely to increase in the future due to climate change (Intergovernmental Panel on Climate Change, 2012). It seems "natural" or at least human, to respond to such environmental signals with human action. In relation to floods, humans have created technical flood defense structures, even dyke cultures (Wittfogel, 1957), masses of flood response measures, and yet surprisingly, losses have kept mounting (White, 1945); despite the fact that masses of science and knowledge have been acquired (White, Kates, & Burton, 2001). More recently, nonstructural actions, including large international proclamations, have emerged and these have helped to raise awareness and self-justification of various institutions and efforts, addressing issues such as climate change (Intergovernmental Panel on Climate Change, 2012), disaster risk reduction (United Nations, 2015), integration of flood

management with sustainability (Inter-Agency and Expert Group on Sustainable Development Goal (SDG) Indicators, 2018) and urban planning (United Nations Human Settlement Programme, 2016). Integration and convergence has been the main process for several years in the so-called science-policy nexus. Such integrative approaches are in need of integrative concepts or terms. Resilience as originally defined (Alexander, 2013; Manyena, 2006) has been rebranded as an umbrella term to enable more coercive efforts of different people, disciplines, institutions, and methods for integration. However, this process itself (of meeting a wave of an on-going problem with a wave of terminology and conceptual convergence), has hardly been questioned; such questioning is the aim of this article.

This article is based on observations of the academic debate that has been occurring for several years: many researchers in the context of flood management, hydrology, disaster risk management and related fields have experienced a conceptual transformation of their field, with which they have been struggling (Fekete, Hufschmidt, & Kruse, 2014). This transformation is sometimes termed a paradigm shift, from a focus on hazards to a focus on risk (Grünewald, 2005); from mainly structural flood defense to nonstructural management measures as well; from a focus on a passive impact to a focus on an active understanding of the involvement of humans and their belongings (not just assets, also values), from flood defense to "living with" water (Hartmann & Driessen, 2017). There are multiple aspects and facets to this, but resilience is one that sticks out.

Resilience is a term and a concept: broad, contested and yet mushrooming. It appears to becoming dominant and spreading in certain areas, it is a wave of rebranding, maybe reshaping existing flood management concepts. This short opinion paper seeks out to briefly assess whether this wave in the sense of a trend is still on-going and what implications it has as reflected in the dominant international conceptual frameworks of the United Nations and other organizations. Certainly, this contribution can only indicate starting points for a necessary larger reflection on how and in which areas resilience is indeed still an on-going trend and how and where it really brings about innovation. Even this debate is not novel, but since it still appears to be blossoming and not subsiding, we need to assess what it currently still offers innovation. To be a bit more provocative—should those that have abstained from adopting resilience up until now jump on the bandwagon or is there more to be gained from exploring alternatives?

First, we acknowledge the impact of resilience among other paradigm change aspects, such as sustainability, upon modernizing flood risk management (FRM). Traditional flood control or defense measures can only protect up to a certain level and protect only against certain types of flooding (i.e., coastal or river floods; Hartmann & Juepner, 2014). The need for a resilience approach is generally accepted in academia and practice (Petrow, Thieken, Kreibich, Merz, & Bahlburg, 2006; Rodina, 2018; Roth & Warner, 2007). Flood-resilient cities reduce the vulnerability of cities against floods while maintaining the basic functions of urban areas (Rosenzweig et al., 2018). Making cities flood-resilient is an urgent challenge to sustainable urban living (Davoudi et al., 2012; Hammond, Chen, Djordjević, Butler, & Mark, 2015; Klijn & Koppenjan, 2012; Papa, 2012). Resilience has become increasingly popular over the last decades in academic literature on natural hazards in general (Bruneau et al., 2003; Fuchs & Thaler, 2018; Gallopín, 2006; Kelman, Gaillard, Lewis, & Mercer, 2016; MacAskill & Guthrie, 2014; Simonovic & Peck, 2013), and on FRM in particular (De Bruijn, Diermanse, & Beckers, 2014; Duckstein, Plate, & Benedini, 1987; Morrison, Westbrook, & Noble, 2018; Roth & Warner, 2007). Within FRM, the trend for resilience goes along with a major paradigm shift in the way society deals with floods, which started in the 1990s, when Rhine River floods triggered a rethinking of flood protection in the Netherlands, and later in Germany (Hartmann, 2012), and a more risk-based approach has been embraced (Begum, Stive, & Hall, 2007; Immendorf, 1997; Patt & Jüpner, 2001). The rethinking has been shaped by a greater understanding of the challenges to managing complex socio-ecological systems in general.

Does resilience contain novelty as a concept or does it simply re-brand (flood) risk management (Cutter et al., 2008; Fuchs & Thaler, 2018; Manyena, 2006)? Resilience is often discussed as a new flood management approach (Begum et al., 2007; Bruijn, 2005; Petrow et al., 2006). However, this alleged novelty is contested, since some professionals see on-going FRM as already including all aspects of resilience. However, this depends very much on how resilience is defined and applied. When resilience is regarded to be the same as ductility, elasticity, or robustness, it might indeed not offer much novelty. It does offer novelty, however, when resilience is used to advocate nonlinear relations, dynamics states of stability or notions of transformation (Park, Seager, Rao, Convertino, & Linkov, 2013). For example, socio-economic implications that go beyond design parameters of engineering can be viewed as novel inter- or transdisciplinary challenges. Quite a few social scientists are very vocal in expressing their opinion that resilience should include more than just the rebound notion and embracing change and transformation, even demanding for more societal and political interaction to achieve societal transformation (Kuhlicke, 2013; Lorenz, 2013; Pelling, 2011; Weichselgartner & Kelman, 2014). However, demanding more integration of societal processes into risk processes itself is not a novelty (Hewitt, 1998; Jander, Schramke, & Wenzel, 1982). Systems theory already went beyond a return to status quo process understandings and emphasized a spiral development instead of a cyclical one decades ago (Chorley & Kennedy, 1971).

More integration of actors or disciplines is also not a novelty itself. Stakeholders that need to be involved in resilience-based FRM strategies include urban planners (Hammond et al., 2015), homeowners and landowners (Hartmann et al., 2019). Different actors or disciplines (Di Baldassarre, Kemerink, Kooy, & Brandimarte, 2014) define resilience differently, making resilience a controversial term (Di Baldassarre et al., 2014; Rosenzweig et al., 2018). However, some argue this did not stop resilience from becoming a trend and definition debates actually also stimulate dialogue (Fekete et al., 2014). What had once been termed needs assessment; capacity development is currently also being rebranded under resilience. However, alternatives are also emerging such as the term inclusiveness that is currently being promoted to carry the idea of integrating not only neglected social groups or human individuals but to serve as a general idea of multi-actor involvement (United Nations Human Settlement Programme, 2016).

2 | RESILIENCE: A TREND THAT BRIDGIES SCIENCE AND PRAXIS

The following section analyses the concurrent promotion of resilience within selected international institutions. It will then compare it with findings from a local international workshop. It then investigates the relations of societal reactions to major events and changes in disaster patterns.

The Sendai Framework for Disaster Risk Reduction (SFDRR; United Nations, 2015) is, next to the sustainable development goals and the IPCC negotiations, a guideline that enables integration of thematic fields and emphasizes using resilience concepts and their operationalization. However, resilience also plays a prominent role bridging topics, stakeholders and research within other thematic fields, and international processes. For instance, the United Nations Human Settlement Programme (UN/HABITAT) new urban agenda demands better integration of topics such as natural hazards and urban development. Flood risk and resilience is a topic that matches such current international research and policy streams, for instance, "resilient cities" (Fekete & Fiedrich, 2018; United Nations International Strategy for Disaster Reduction, 2012). This is also echoed within processes fostered by the Sendai Framework stakeholders, such as the United Nations International Strategy for Disaster Reduction, which for many years (since 2012 at least), has pushed global as well as local science-practice dialogues, for instance, within the "Make My City Resilient" campaign (United Nations International Strategy for Disaster Reduction, 2012), but also by other actors such as the Rockefeller foundation, ICLEI—Local Governments for Sustainability, and many others. However, a demand echoed across such international frameworks is the need to elaborate the conceptual implications by showing applicability and operationalization of resilience. For academic fields, operationalization means resilience must be translated into methods and operationalized by quantitative or qualitative assessments. Especially, since resilience has become a widespread topic in academic research and FRM (Morrison et al., 2018), and no longer only a strategic agenda setting for international organizations, it is important for each discipline to develop their own resilience assessment specifics. At the same time, more cross-disciplinary collaboration is required to enable mutual learning, transferability and advancement of resilience research. The rise of resilience not just as a short-lived trend or purely political phenomenon that is observable across academic disciplines, but also within water-related fields of research (Figure 1). While in water-related studies, this trend appears to continue to rise, in other disciplines it might already have seen its hiatus (Park et al., 2013).

Another demand reiterated by the Sendai Framework as well as by its predecessors, the Hyogo Framework, for instance, is to generate not only interdisciplinary but also transdisciplinary cooperation.

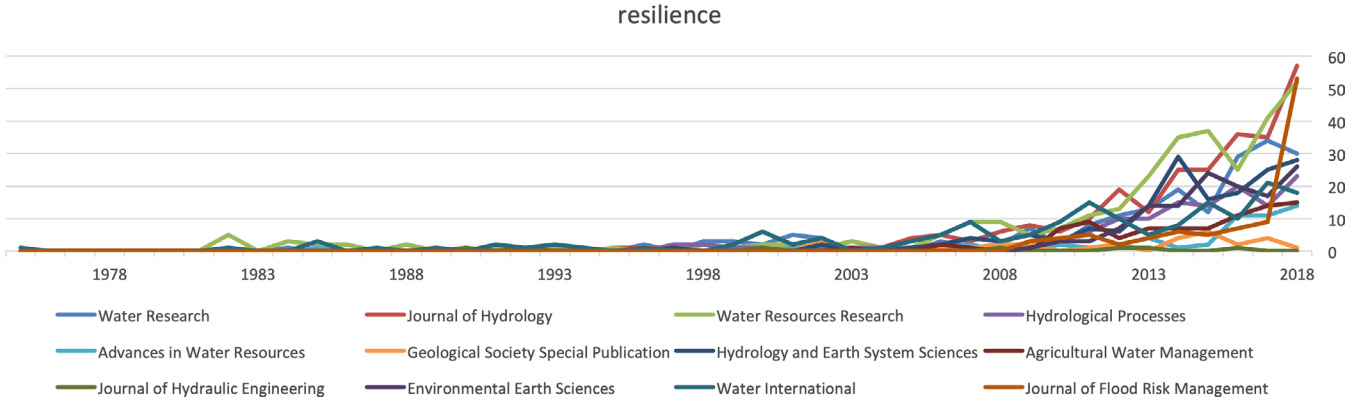

FIGURE 1 Journal articles in highly cited water-related journals on "resilience"

Who can generate transdisciplinary exchange—international scale organizations only? Transdisciplinary cooperation is generated by organizations such as the UN or World Bank at high levels internationally, but the need for local interactions of stakeholders must also be emphasized. By bringing disciplines and stakeholders together (e.g., in the form of workshops) resilience and hence, risk reduction, is advanced. Certain opportunities but also challenges in integrating resilience into existing FRM approaches were identified in an international science-practitioner workshop in Kaiserslautern, Germany, April 11–13, 2018. The main findings of the working groups in the workshop were the following (Jüpner et al., 2018): understanding flood risk better, including better flood risk communication and exchange between countries; more science-policy interfaces, thus enabling modern holistic FRM approaches; integrating industrial and private sectors and advising flood-adapted building and construction to build back better. These findings match the four main priorities of the SFDRR (Jüpner et al., 2018). Implications arising from these findings are that the demands of the Sendai Framework can be underlined and that it still seems to be necessary to expand knowledge about risks and resilience. Expansion of knowledge, it was identified at the workshop, is mainly necessary at traditional disciplinary borders or where authorities obligations end. For example, those scientists analyzing and designing dams can calculate risk and damage curves for that structure but have no models or formula for assessing damage to populations potentially affected by dyke breaches. Further, concepts such as resilience in a broader understanding than just "bouncing back" often seem to defy parameterization or at least pose challenges to integrate it into deterministic linear risk curves. While this in itself is neither a new finding for international audiences nor the experts themselves, the demand to combine or advance existing risk functions on resilience or on fields beyond original research certainly has to be experienced by researchers themselves by external demand, it appears.

It is characteristic of the field of disaster risk management, and also FRM, to often produce novel insights, standards and conceptual models under the impression of new disaster occurrences. Is resilience suitable to react to novel events and can it offer a more sustainable (in the sense of lasting) concept that is not exchanged for another concept after another major event? So-called flash floods are recently perceived as a rising phenomenon in Central Europe. Phenomena such as pluvial, now often termed torrential rainfall or flash floods, have been topics for local hydraulic engineers for many decades. What is novel about them, is the dimension of variability of weather and climate, and the societal expectations and demands in the light of more awareness of climate change. In this case, a slight change in weather patterns mirrors a slight change in public perception. Also small changes may trigger societal reaction, when the phenomenon persists and spreads; it does not always need to be a major national event. Demands on "understanding risk" are also changing in society when traditional concepts of calculating exceedance thresholds and adding residual risk "safety margins" is not deemed sufficient anymore. These changes can be introduced by new concepts such as the Sendai Framework. Resilience seems to require more than just coping with an extreme overflow, it also entails incentives to advance FRM to recovery schemes (Slavikova, 2018). Societal demands can be contradictory however, which puts engineers as well as planners at unease; damaging events are less accepted as society develops to more safe and secure conditions, as coined by the vulnerability paradox (NOTA—Rathenau-Instituut, 1994); the more developed a society, the more susceptible to even minor disturbances it becomes. Therefore, traditional risk acceptance models will be challenged, as a resilience approach discriminates much more between land-uses—flood protection is not provided as an equal public good, but instead resilience triggers different priorities for vulnerable and less vulnerable land-uses (van Ruiten & Hartmann, 2016). This essentially questions existing aspects of justice in FRM (Thaler & Hartmann, 2016) and potentially raises conflicts. This calls for a joint effort and different risk cultures and governance.

It is a challenge for traditional engineers to embark on such social science topics and inter- as well as transdisciplinary training and cooperation is needed (Jong & van den Brink, 2017). This is largely congruent with the other priorities of the Sendai Framework and with many other international frameworks such as the Paris Agreement, new urban agenda and SDGs. However, one must also remain cautious and aware that international science-policy agendas are driven by (often well intended and vested) interests that can invoke necessary incentives and innovations but also can evoke (necessary) skepticism and also negative unintended side effects. For example, the call for more private sector involvement can do good by fostering the awareness of societal responsibility and investments of companies into more security (Seher & Löschner, 2018), according to one Sendai priority. However, such private sector involvement entails a shift in the notion of justice and first experiences also show pitfalls, such as the lessons we can draw from the UK partnership funding schemes in FRM (McCarthy, Viavattene, Sheehan, & Green, 2018). We therefore wish to refrain from statements such as calling for more societal transformation in regard to any of those processes, since it can be very necessary in one context or country, but can change and be misused in another or later context. It is certainly important to modernize existing floods risk management concepts and resilience can offer new stimuli for methodological advancement, the experts concluded. Also directing efforts in line with international frameworks such as Sendai is helpful to direct efforts and close gaps of knowledge and action. Some of the gaps are appalling, such as inability to report simple damage or mortality numbers to Sendai and other indicators. However, resilience also calls

for being more than just damage and loss accounting and besides satisfying societal, political or economic demands, it still seems necessary to also advance scientific methods in sync. An unsolved question remains here; how much in sync does scientific methodological and conceptual development need to be with political and societal transformation—and how much independence of scientific work is necessary on the other hand?

3 | CONCLUSION

Is resilience still a trend within FRM? We conclude it is, given the publication trend curves, and the current prominence in international frameworks. But what does this imply, is it a good thing or could there be pitfalls? At the moment there is still much to be gained by even better and more widespread integration of fields, ideas, concepts, methods, data and last, but not least people. So, terms such as resilience, which have been rebranded to contain a notion of embracing pre-existing concepts such as risk management and many others, seem logical, even scientifically and politically necessary to foster more integration. More integration means bridging gaps, matching interests, avoiding end-of pipe development, so who could be against it? Well, the struggle with definitions has been heard, limitations of too complex models for explanations are known within statistics or elsewhere. But what probably has not been investigated enough still, is what has been glossed over by an overt focus on resilience. It could be a convergence of ideas and mainstreaming of efforts, which in many venues and lines is absolutely necessary and can help, for example, to decrease silo-thinking. But as academics, we have a mandate to remain skeptical, too and remain on the look-out for novelty. Resilience has helped to stress dynamics, future states and a holistic and even transformative picture on how floods are analyzed and managed. But how much of this had pre-existed under the terms risk, or system analysis or community capacity building before? And what is novel, or unique about resilience when it simply amalgamates everything that pre-existed? These questions have been discussed by many researchers and practitioners for years and will continue to be discussed. So, should the FRM community still adopt or rather, "leap-frog" resilience? From a pragmatic and opportunistic point of view, resilience cannot be ignored. But a few fresh ideas other than reiterating and converging what had already been discussed would be invigorating, too.

There are multiple arguments that resilience can offer advancements to traditional FRM. Even though many conceptual components such as robustness or redundancy were already available before the trend "wave" of resilience arose. But researchers must also recognize that FRM has limits. While indirect damage types, coping and adaptive capacities have already been regarded under risk assessments, they have only been integrated as components under the focus of risk as a potential range of futures. Resilience turns the perspective towards the capabilities and their gaps and the system dynamics after impact. Of course, resilience can just be a re-branding of a previous formula or conceptual components. It must be recognized that such opportunism helps integration but glosses over the hard question what resilience really offers in difference to previous or other concepts. It must also be warned against putting all unfulfilled problems and hopes from FRM into resilience. And while integration and convergence of concepts continues, fostered by the umbrella character of resilience, there remains a need for researchers to think and stay outside of this box.

CONFLICT OF INTEREST

The authors have declared no conflicts of interest for this article.

AUTHOR CONTRIBUTIONS

Alexander Fekete: Conceptualization; writing-original draft. **Thomas Hartmann**: Conceptualization; writing-original draft. **Robert Jüpner**: Conceptualization; writing-original draft.

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