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ARTICLE

Disaster Risk Resilience: Conceptual Evolution, Key Issues, and Opportunities

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Abstract Resilience has become a cornerstone for risk management and disaster reduction. However, it has evolved extensively both etymologically and conceptually in time and across scientific disciplines. The concept has been (re)shaped by the evolution of research and practice efforts. Considered the opposite of vulnerability for a long time, resilience was first defined as the ability to resist, bounce back, cope with, and recover quickly from the impacts of hazards. To avoid the possible return to conditions of vulnerability and exposure to hazards, the notions of post-disaster development, transformation, and adaptation (build back better) and anticipation, innovation, and proactivity (bounce forward) were then integrated. Today, resilience is characterized by a multitude of components and several classifications. We present a selection of 25 components used to define resilience, and an interesting linkage emerges between these components and the dimensions of risk management (prevention, preparedness, response, and recovery), offering a perspective to strengthen resilience through the development of capacities. Despite its potential, resilience is subject to challenges regarding its operationalization, effectiveness, measurement, credibility, equity, and even its nature. Nevertheless, it offers applicability and opportunities for local communities as well as an interdisciplinary look at global challenges.

Keywords Community · Disaster risk · Resilience · Sustainable development

1 Introduction

Over the last two decades, the interest in the concept of resilience has grown significantly in the scientific community. Over the past 20 years, more than 30,000 articles with the term resilience in the title or keywords have been indexed in the SCOPUS database. In 2017 alone, more than 200 papers were published on resilience in the field of risk and disaster management—a sevenfold increase from 10 years earlier (n = 30 in 2008) (Demiroz and Haase 2019). Through this explosion of interest, the concept of resilience has evolved greatly and has been widely discussed within the scientific community. The purpose of this review is to present the conceptual evolution of resilience in the risk and disaster management field while highlighting its principal components, major issues, and best opportunities.

2 Etymology and History of the Resilience Concept

The term resilience has a long and diverse history. Alexander (2013) and O'Brien and O'Keefe (2013) traced the history of the use of the term as well as its etymological evolution through the major eras. Its exact origin is unclear, but resilience is thought to come from the Latin *resilire*, *resilio* meaning "to leap" (Manyena et al. 2011; Alexander 2013). Both terms were used by Seneca the Elder, Ovid, Cicero, and Livy in their works in classical antiquity to mean leaping, jumping, or bouncing. In the Western Middle Ages and then in Modern Times, the term *resiler*

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was used in Middle French to express the action of retracting, and the term *resile* was used in England to express the fact of retracting, returning to an old position, resisting. The first known scientific use of the term resilience was in 1625 by Sir Francis Bacon, an English attorney general, in the *Sylva Sylvarum*, a collection of writings on natural history. The first known definition of the word comes from the Glossographia published from 1618 to 1679. Its author, Thomas Blount, gave it a double meaning: to bounce and to go back on one's word. From 1839 onwards, the term resilience was associated with the ability (strength) to recover from adversity. At the end of the nineteenth century a prominent Scottish engineer, William J.M. Rankine, used the term in the field of mechanics to designate the strength (resistance) and ductility (ability to be stretched without breaking) of steel beams. As early as 1950, the concept began to be used in ecology and psychology, two fields in which it would become very important. The ecologist Holling (1973) later conceptualized resilience as a measure of an ecosystem's ability to absorb disturbances and persist without changing its fundamental structure. In the late 1990s, the concept migrated from natural ecology to human ecology because of economists and geographers. In the field of risk and disaster management, the concept of resilience started to be used in the 1970s but gained importance especially from the end of the twentieth century and after 2010 (Demiroz and Haase 2019).

The broad evolution of the concept of resilience can be explained by its journey in time across various disciplines. Widely used, its meaning evolved as it has gained importance in fields such as ecology, psychology, engineering, social sciences, and so on (Alexander 2013; O'Brien and O'Keefe 2013). The major definitions from several fields and disciplines are presented in Table 1. Although there is currently no real consensus on the definition of resilience in risk and disaster management, the definition of the United Nations Office for Disaster Risk Reduction (UNDRR 2021), formerly UNISDR, is probably the one most recognized.

3 Conceptual Evolution of the Term Resilience in Risk and Disaster Management

Over the past two decades, the concept of resilience has been highlighted by the evolution of research and practice efforts in the field of risk and disaster management. These efforts have long been oriented towards post-disaster response and recovery (Cronstedt 2002; Cutter et al. 2014), rather than pre-event initiatives such as prevention and preparedness (Hyunjung 2018). Subsequently, divergent approaches from natural and social sciences have focused either on the hazard itself, or on vulnerability. All these approaches aimed at making communities more resilient to hazards by reducing the hazard itself (frequency, intensity, and so on) or by working on the vulnerability factors of communities (sensitivity, exposure, and so forth). Although these approaches have contributed greatly to disaster risk reduction (DRR), as well as to sustainable community development, they are still considered as part of a reactive framework (Hyunjung 2018). According to many (for example, Innocenti and Albrito 2011), a more progressive and proactive approach to risk reduction is needed and the

Table 1 Main definitions of the term resilience within different scientific disciplines

Field/discipline	Definition	Reference(s)
Ecology	"A measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables."	Holling (1973, p. 14)
Social–Ecological Systems	"The degree to which a complex adaptive system is capable of self-organization and the degree to which the system can build capacity for learning and adaptation."	Adger et al. (2005, p. 1036)
Mathematics, Physical Sciences, Engineering	"The ability of a material or system to bend or resist without breaking, and the speed at which it returns or 'bounces back' to equilibrium after a displacement."	Aldunce et al. (2014, p. 255)
Psychology, Psychiatry, Social Sciences	"The process, outcome or capacity of individuals and communities to resist, recover, and return to baseline functioning after a misfortune, stress, or external shock."	Aldunce et al. (2014, p. 255)
Risk Management, Disaster Risk Reduction	"The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management."	UNDRR (2021)
Climate Change Adaptation	"The capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure while also maintaining the capacity for adaptation, learning and transformation."	IPCC (2018, p. 557)

risk paradigm should no longer focus solely on reducing vulnerability, but also on building resilience (McEntire et al. 2002; Cutter et al. 2008; Olwig 2012; Twigg 2015; Williams and Shepherd 2016). It is in this context that current efforts are increasingly oriented towards risk reduction that focuses on building and strengthening resilience, including the valorization of positive factors such as local capacities and social capital (Hyunjung 2018).

The United Nations International Strategy for Disaster Reduction (UNISDR) established as the second strategic goal of the Hyogo Framework for Action 2005−2015:

> […] the development and strengthening of institutions, mechanisms and capacities at all levels, in particular at the community level, that can systematically contribute to building resilience to hazards (UNISDR 2005, p. 4).

The concept of resilience then gained importance until it was used 60 times in the Sendai Framework for Disaster Risk Reduction 2015−2030. The Sendai Framework makes it its third priority for action: "Investing in disaster risk reduction for resilience" (UNISDR 2015, p. 14). The explosion of interest in resilience over the last decade has thus contributed to the evolution of the concept and the development of different visions, or even schools of thought, of resilience in the field of risk and disaster.

Resilience and vulnerability have long been considered as opposing, interdependent, or correlated concepts. Some refer to resilience as the inverse of vulnerability (Twigg 2007). Thus, increasing resilience would reduce vulnerability and vice versa (Chisty et al. 2021). Resilience and vulnerability have also been considered by others to be subcomponents, subconcepts, or attributes of each other (Turner et al. 2003). Many, however, consider them to be subcomponents of the concept of risk (Cutter et al. 2008; Aven 2011) since one (vulnerability) consists of factors that increase risk and the other (resilience) consists of factors that reduce risk. In this sense, a good understanding of vulnerability is the starting point for building resilience (Alexander 2013), and resilience is now "deployed as a strategy to overcome the vulnerability of communities in the wake of natural disasters" (McDonnell 2020, p. 56). However, while all these thoughts on the conceptual positioning of resilience in relation to vulnerability have their accuracy, they rather represent simplistic translations of the complex and multidimensional character of these two concepts. In the end, it appears that resilience has evolved into an independent concept, albeit one that is related to, and interconnected with, vulnerability.

From ecology and engineering, resilience was characterized as the ability to resist, bounce back, cope with, and recover quickly from the impacts of hazards (Mileti 1999; Alexander 2013). Linked to a rather reactive risk strategy, the focus is on the resistance of infrastructures and systems and the speed of return to the initial pre-disaster state (bounce-back). Resilience is thus visualized as an elastic band that can stretch without breaking (ductility) and return to its original shape without deforming. This perspective of resilience thus induces a return to the pre-disaster conditions of the system or community without thinking, without regard to their evaluation, making it possible to return to the conditions of vulnerability that may have caused the hazard or exacerbated its impacts (Paton and Johnston 2017).

To address this challenge, the notion of "build back better" and "bounce forward" has been developed within risk management and has contributed to the integration of post-disaster development, transformation, and adaptation capacities within resilience (Kennedy et al. 2008; Manyena et al. 2011; Béné et al. 2012). Disaster is then seen as an opportunity to improve, change, and thus adapt (Paton 2006). From this point of view, resilience represents "the intrinsic capacity of a system, community or society predisposed to a shock or stress to bounce forward and adapt in order to survive by changing its non-essential attributes and rebuilding itself" (Manyena et al. 2011, p. 419). At the heart of this conception of resilience is a well-known mechanism of human development: experiential learning (Manyena et al. 2011). Particular emphasis is placed on the reporting of events, as they feed into the processes of reflection, learning, and feedback necessary to build on lessons learned. This perspective on resilience also opens the door to planning and action over longer time horizons. However, in the context of risks and disasters, this conception of resilience remains reactive.

Recently, the meaning associated with the expression "bounce forward" seems to have shifted to a new one, more focused on proactivity. This new conceptual input idealizes resilience as the ability to leap beyond risk rather than bounce back. Greater importance is then given to the capacities of anticipation, innovation, and adaptability to uncertainties (Rubim and Borges 2017). Until recently, resilience was divided into three main visions and objectives: (1) to reduce impacts and consequences; (2) to reduce recovery time; and (3) to reduce future vulnerabilities (Koliou et al. 2020). This new perspective opens the door to a fourth vision: that of reducing the impact of uncertainties. Moreover, this representation favors the development and the reinforcement of resilience without having undergone a prior shock.

Ultimately, through its various phases of conceptual evolution, resilience is now defined by its three complementary dimensions: bounce back, build back better, and bounce forward. This combination of meanings makes resilience a difficult concept to define in any straightforward way.

4 Key Components of Resilience

Resilience is made up of an assemblage of several components that have multiplied through its conceptual evolution. Whether it is through the analysis of an individual, a community, or a complex system, many have worked to deconstruct, structure, and order the properties of the concept. For Tierney and Bruneau (2007), resilience is composed of four main elements: robustness, redundancy, resourcefulness, and rapidity. According to Béné (2013), resilience relies instead on the synergy of three capabilities: absorption, adaptation, and transformation. For Chen et al. (2020), resilience to disasters can be summarized by three distinct capacities: the capacity to resist, adapt, and recover quickly. In a non-exhaustive way, Table 2 presents 25 components mentioned and frequently used to define resilience in the risk and disaster management literature.

When we observe the meaning of the listed components of resilience, they can be classified according to their conceptual dimension (Fig. 1). To facilitate operationalization, the components with similar meanings and processes can be gathered into groups of actions.

Looking at their nature, many of the components of resilience show an interesting fit with the actions, strategies, and time horizons of the four basic dimensions of risk management: prevention, preparedness, response, and recovery (Fig. 2). Some components of the "bounce forward" dimension apply to all dimensions of risk management such as innovation, flexibility, or autonomy, for example. While many see a conflict in the different conceptual views of resilience, we see it as a process that recognizes the gains of each of the major phases of the term's evolution. Through this perspective, resilience would likely be strengthened at each stage of risk management using different capacities. Norris et al. (2008) presented a similar view of resilience as a set of attributes and capabilities in dynamic relationship.

5 Community Resilience

Within the field of risk and disaster management, building resilience is often community-oriented due to the importance of the local scale. Hazards generally occur locally and many of the most effective tools for reducing exposure are found at this scale. The impacts of disasters are felt immediately and intensely at the local level and local actors are the first responders. It is also at the local level that the core functions of environmental management and regulatory governance are concentrated and where governments and communities best engage and work together (UNDRR 2019). Because each community is composed of a complex and dynamic assemblage of social, economic, and natural environments (Meng et al. 2018), it is the ideal entity to develop or strengthen a resilience that is unique to that community and that will act effectively to manage the risks. Furthermore, to adequately represent the diversity within the vulnerable groups of a community, it is important to pay attention to its intersectional characteristics (Chisty et al. 2021).

According to Norris et al. (2008), the emergence of community resilience would be based on a variety of adaptive capacities grouped into four broad networked sets: economic development, social capital, information and communication, and community competence. These capabilities are characterized by dynamic attributes such as robustness, redundancy, and speed. Amobi et al. (2019) argued that community resilience is based on three key fundamentals: community leadership, social cohesion, and social connections. For Haase et al. (2021), community resilience is the result of six core capacities: human capital, physical capital, economic capital, social capital, institutional and environmental capital, and these encompass the 9 elements and 19 subelements proposed by Patel et al. (2017).

Among the many dimensions at the heart of community resilience are two fundamental notions: social learning and social capital. Social learning is defined as "a process of iterative reflection that occurs when we share our experiences, ideas and environments with others" (Keen et al. 2005, p. 9). This concept is found, among others, at the basis of adaptive management (McEwen et al. 2018) and is a driver of social change. The concept of social capital has its roots in sociology but is now widely used in different fields (Chelihi et al. 2020). According to the sociologist Bourdieu (1986, p. 247), social capital represents: "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition." It is then considered as a resource that is acquired and maintained individually (Chelihi et al. 2020). For others, social capital constitutes "resources and attributes of social organization (communities, regions, countries)" (Chelihi et al. 2020, p. 9) and encompasses both links and networks, as well as norms and values shared by the community. Norris et al. (2008) considered social capital as a combination of social support, social embeddedness, organizational ties, leadership and sense of community.

Resilience building actions and interventions are mostly carried out at the community level (McDonnell 2020), often through a community-based approach. This type of approach is used in several areas, whether it is for DRR (community-based disaster risk reduction—CBDRR), management (community-based management—CBM),

Table 2 Main components of resilience frequently used in the disaster management literature

Components	Definition	Reference(s)
Absorptive capacity	"The ability of the community to absorb event impacts using predetermined coping responses."	Cutter et al. (2008, p. 603)
	"The capacity to take intentional protective action to cope with known shocks and stresses."	Jeans et al. (2016, p. 17)
Adaptability	"The accumulative experience […] in previous disasters."	Chen et al. (2020, p. 3)
	"The capacity of social-ecological systems of learning, combining experience and knowledge, to adjust their response to pressures."	Oliva and Lazzeretti (2017, p. 72)
Adaptive capacity (adaptivity)	"The ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences."	IPCC (2014, p. 1758
	"The ability of the system to reorganize and transform its shape and its functions to minimize the impact of disturbances."	Oliva and Lazzeretti (2017, p. 71)
	"The capacity to make intentional incremental adjustments in anticipation of or in response to change, in ways that create more flexibility in the future."	Jeans et al. (2016, p. 17)
	"The ability of a community to react to changes to its environment, to adapt, learn from experiences and crucially, to be able to develop new structures based on internal, local interactions."	Davis et al. (2021, p. 1568)
Anticipation	Process of "horizon scanning to identify potential dangers, registering those in a formal typology and recognition of the changing nature of risks that need to be continually identified and re-assessed."	Rogers (2011, p. 55)
Autonomy	"To withstand an extreme natural event […] without a large amount of assistance from outside the community."	Mileti (1999, pp. 32−33)
Connectivity	"The ability to create and maintain a connection […]."	Reggiani et al. (2015, p. 5)
Connectiveness	"The strength of internal connections that mediate and regulate the influences between inside processes and the outside world […]."	Holling and Gunderson (2002, p. 50)
Coping capacity	"The ability of people, organizations, and systems, using available skills and resources, to manage adverse conditions, risk or disasters. The capacity to cope requires continuing awareness, resources, and good management, both in normal times as well as during disasters or adverse conditions."	UNDRR (2021)
	"The ability of people, institutions, organizations, and systems, using available skills, values, beliefs, resources, and opportunities, to address, manage, and overcome adverse conditions in the short to medium term."	IPCC (2014, p. 1762)
Diversity	"Having both a number and a variety of means to realize a given resilience function."	Frankenberger et al. (2013, p. 24)
Ductility	Capacity to survive the application of a force by "absorbing it with deformation."	Alexander (2013, p. 2710)
Flexibility	"Willingness and ability to change, evolve and adapt in response to changing circumstances."	UNDRR (2019, p. 52)
Inclusivity	"To emphasize the need for broad consultation and participation."	UNDRR (2019, p. 52)
Innovation	"The successful application of new ideas."	Jeans et al. (2016, p. 30)
Learning capacity	"Processes that enable people to learn together, support experimentation and increase the potential for innovation (social and technological)."	Jeans et al. (2016, p. 25)
Preparedness	"The knowledge and capacities developed by governments, response and recovery organizations, communities, and individuals to effectively anticipate, respond to and recover from the impacts of likely, imminent or current disasters."	UNDRR (2021)
Rapidity	"The capacity to restore functionality in a timely way, containing losses and avoiding disruptions."	Tierney and Bruneau (2007, p. 15)
Recovery capacity	"The ability that facilitates […] recovery to original state or a new equilibrium state after a disaster."	Chen et al. (2020, p. 3)

Table 2 continued

Components	Definition	Reference(s)
Redundancy	"The extent to which systems, system elements, or other units are substitutable, that is, capable of satisfying functional requirements, if significant degradation or loss of functionality occurs."	Tierney and Bruneau (2007, p. 15)
	"Spare capacity purposely created to accommodate disruption and multiple ways to fulfill a particular need."	UNDRR (2019, p. 52)
Reflectiveness	"Learning from the past and adjusting."	UNDRR (2019, p. 52)
Reflectivity	"A system attribute where cause and effect form a feedback loop, in which the effect changes the system itself."	IPCC (2014, p. 1771)
Resistance	"Ability to effectively block a stressor" and avoid any dysfunction.	Norris et al. (2008, p. 132)
	"An ability of urban to withstand disasters by its own functions and maintain the normal operation of the system."	Chen et al. (2020, p. 3)
Resourcefulness	"The ability to diagnose and prioritize problems and to initiate solutions by identifying and mobilizing material, monetary, informational, technological, and human resources."	Tierney and Bruneau (2007, p. 15)
	"Rapidly find alternative ways to achieve goals or meet need."	UNDRR (2019, p. 52)
Robustness	"The ability of systems, system elements, and other units of analysis to withstand disaster forces without significant degradation or loss of performance."	Tierney and Bruneau (2007, p. 15)
	To "accommodate certain failures and ensure that failure is predictable."	UNDRR (2019, p. 52)
Self-organization	"The capacity to form networks, institutions, organizations, or other social collectives independently from the state or other central authority."	Matyas and Pelling (2015, p. 13)
Transformability (Transformative capacity)	"The capacity to create a fundamentally new system when ecological, economic, or social (including political) conditions make the existing system untenable."	Walker et al. (2004, p. 5)
	"The capacity to make intentional change to stop or reduce the drivers of risk, vulnerability, and inequality, and ensure the more equitable sharing of risk so it is not unfairly borne by poor and vulnerable people."	Jeans et al. (2016, p. 17)

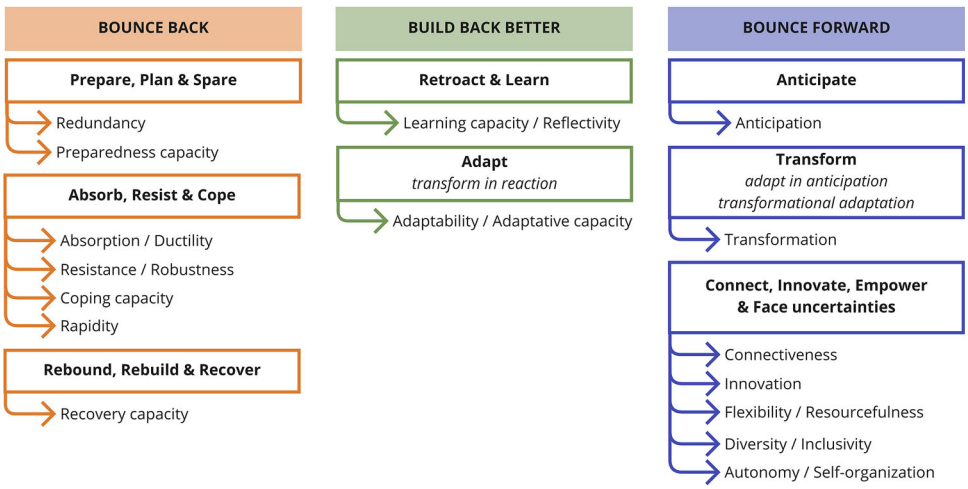

Fig. 1 Components of resilience according to their conceptual dimensions

adaptation (community-based adaptation—CBA), or development (community-driven development) objectives. It represents "a community-led process, based on communities' priorities, needs, knowledge, and capacities, which should empower people to plan for and cope with the impacts of climate change" (Reid et al. 2009, p. 13), disaster risk, or sustainable development challenges. Based on the principle of inclusiveness, this approach places social aspects and the role of communities at the center of disaster risk management (Frankenberger et al. 2013). All members of the community are actively involved in decision making at all stages of the process (Shaw 2016), using

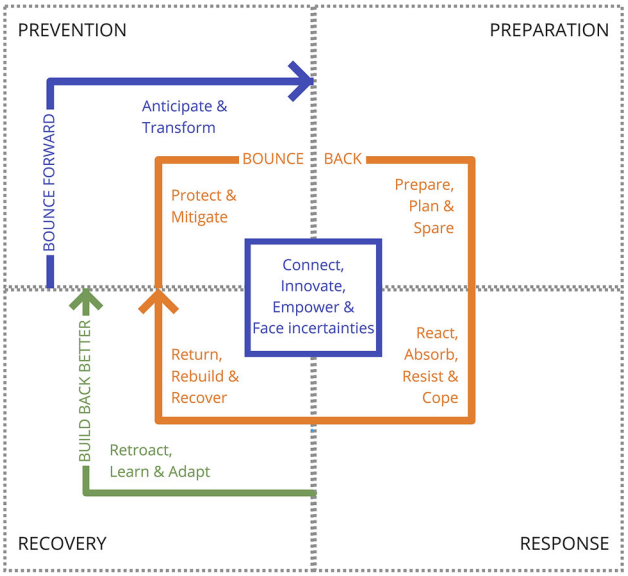

Fig. 2 Conceptual evolution of resilience according to risk management dimensions

participatory processes that mobilize a diversity of local actors and value local knowledge (Berkes 2007; Bahadur et al. 2013). The CBA is also based on the development of autonomy and self-organization of communities through capacity building of local actors. To enable communities to make the necessary transformations, this approach needs a decentralization of powers and the transfer of resources for effective risk management, local development, and environmental governance (Bahadur et al. 2013; UNDRR 2019; Davis et al. 2021). Proponents of this approach emphasize strengthening networks, connections, relationships, and social capital as well as improving community engagement and understanding (Mileti 1999; Gunderson and Folke 2005; Norris et al. 2008). It is also directly connected to the bottom-up management process whose activities can then be institutionalized (Shaw 2016). The UNDRR's Local Risk Reduction and Resilience Strategy is a planning tool for local actors to integrate a DRR approach into local development and resilience building (UNDRR 2019).

6 Issues and Challenges

Resilience is a very promising concept for disaster risk management, but the lack of consensus on its definition is still a major challenge to its operationalization and assessment (Bollettino et al. 2017). To date, there is no unified approach to resilience, no single way to define it, measure it, or promote it to our communities (Demiroz and Haase 2019), which poses a challenge to its practical application. Because resilience is a complex, multi-dimensional and multi-scalar term, it brings several complications to its application. Its use implies a sharing of challenges and responsibilities between scales of intervention and practice and thus requires a multi-sectorial, multi-scalar, and inter-scalar approach (Bahadur et al. 2013; Bahadur and Pichon 2016). Some authors even consider the concept too imprecise to contribute significantly to DRR (Manyena 2006).

As an umbrella concept with many intangible factors, resilience is even more difficult to measure and model, further complicating the assessment of measures that claim to develop or strengthen it (Berkes and Ross 2013; Cutter 2016; Bollettino et al. 2017). While across the scientific community, a wide variety of approaches, frameworks, indices, and indicators have been developed to assess it (Ruszczyk 2019; Clark-Ginsberg et al. 2020), there is still little empirical data on the actual understanding and use of resilience by practitioners (Matyas and Pelling 2015). To date, it remains difficult to justify funding for resilience-based activities and to assess the results in a reliable and effective way for communities and investors.

There is also a lack of consensus on what resilience is. In the policy context, the concept is often used as an endpoint, an ideal to be achieved. In the sciences, resilience represents an attribute or a set of attributes, capacities, and conditions that can be developed, constructed, and measured (Reghezza-Zitt et al. 2012). For others, it should be considered as: "a complex of social processes that allow local communities to self-organize and enact positive collective action for community survival and wellbeing" (Imperiale and Vanclay 2016, p. 207). In this sense, resilience represents a process or set of processes, rather than an endpoint, involving learning, anticipation, and improvement of basic structures, actors, and system functions (Norris et al. 2008; Mitchell and Harris 2012). From a utilitarian perspective, resilience can also be understood as both a process and an outcome (Matyas and Pelling 2015).

As a buzzword overused in political discourses since the twenty-first century (Mitchell and Harris 2012; Deeming et al. 2018), resilience has lost some of its meaning and credibility, especially for practitioners and citizens. Moreover, many believe that resilience, especially of communities, necessarily leads to better outcomes for all (Imperiale and Vanclay 2016; Patel et al. 2017) or is a positive indicator of development (McDonnell 2020). Yet the concept could be used to reinforce unethical practices or hegemonies or undesirable situations such as environmental degradation (Alexander 2013; MacKinnon and Derickson 2013), political marginalization of the vulnerable, poverty, or systemic corruption (Mochizuki et al. 2018). To address what some call the "dark side of resilience," it is therefore important to pay particular attention to the power in communities so that the resilience of one group does not come at the expense of another group and

that efforts to strengthen it do not contribute to perpetuating vulnerabilities (Matyas and Pelling 2015; McDonnell 2020). It is thus essential to practice critical resilience thinking through locality and marginality and to ask who benefits from resilience and who pays the cost, especially in the DRR, climate change adaption (CCA), human development, and spatial planning fields (Weichselgartner and Kelman 2015; Cutter 2016).

Furthermore, resilience has been associated with neoliberal perspectives and agendas (Cutter et al. 2013; MacKinnon and Derickson 2013) by encouraging the development of solutions for constant growth and competitive advantages for territories (Oliva and Lazzeretti 2017). From this perspective, resilience can be used as a moralizing discourse that, through the promotion of community autonomy, transfers the heavy responsibility of disaster management to individuals and communities without offering the necessary institutional support for its adequate management (Walker and Cooper 2011; Bankoff 2019; McDonnell 2020). Resilience approaches are generally conducted from an apolitical perspective. Yet, this desire for neutrality can lead to a narrow and one-dimensional resilience thinking that will keep addressing the symptoms rather than achieve the necessary structural transformations (Davis et al. 2021). In the end, all agree on the importance of developing and strengthening community resilience to disaster risks. However, the understanding of resilience is still too unclear to allow for adequate planning of practices on the one hand, and the development of tools and methodologies to address, engage, and strengthen local communities on the other hand (Hutter and Kuhlicke 2013; Mitchell 2013; Imperiale and Vanclay 2016).

7 Opportunities

Despite the challenges it imposes, resilience nevertheless offers a range of opportunities, including that of offering a holistic multi-hazard, even all-hazard, multi-scalar, and integrated approach (Berkes 2007; Bahadur and Pichon 2016). Resilience refers to the capacities of systems, communities, and societies, and these are applicable to different hazards and their dynamics, allowing for an integrative perspective (Ruszczyk 2019).

Then, the concept of resilience has great applicability. It can be applied to almost any phenomenon that involves a shock or stress (Alexander 2013). It offers an answer to the question: How do we prepare for the unknown? (Fekete et al. 2014). More concretely, resilience, as defined in the field of risk and disaster, applies to a broad spectrum of objects, in multiple practice settings, and at multiple spatial and temporal scales. With so many uses and possible applications, it is important to be clear about the parameters of resilience that are being analyzed and put into practice—especially, since there is no single recipe for building resilience, as it is intrinsically linked to the context of its object of analysis (Demiroz and Haase 2019). Thus, the resilience of a family in the context of a pandemic cannot be compared to the resilience of a regional road network in the context of a terrorist risk or to that of a municipality in the context of climate change.

Some consider resilience to be a multidisciplinary concept given its use in many disciplines (Upadhyay and Sangiamwibool 2021). Characterized by a high degree of interdisciplinarity, it constitutes an effective frontier object that allows the bringing together of different political agendas, including those of the humanitarian and development fields (Matyas and Pelling 2015), and thus contributes to the development of transversal competences of actors at all levels. The imprecise nature of resilience and its conceptual flexibility can even benefit communication and knowledge exchange across disciplinary boundaries and between the fields of science, policy, and practice (Klein et al. 2003; Fekete et al. 2014; Weichselgartner and Kelman 2015; Deeming et al. 2018; Moser et al. 2019; Ruszczyk 2019). Resilience also allows for an interdisciplinary look at some global challenges that, until recently, were generally understood separately such as DRR, climate change adaptation, and sustainable development (MacAskill and Guthrie 2014; Weichselgartner and Kelman 2015; Bollettino et al. 2017). Through its evolution, the concept of resilience is moving away from its original definition from ecology, psychology, and the physical sciences and now offers greater interdisciplinarity among these three broad fields (Gero et al. 2011; Schipper et al. 2016; Kelman 2017; Ruszczyk 2019). This inherent interconnectedness contributes to the convergence of ideas but more importantly practices guided by the concept of resilience (Bahadur et al. 2013; Matyas and Pelling 2015; Mochizuki et al. 2018).

Adaptation has gained significant importance as a fundamental component of resilience, establishing an unmistakable conceptual bridge with the notion of climate change adaptation. The latter represents an "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which mitigates harm or exploits beneficial opportunities" (UNFCCC 2021). Adaptation can be incremental and "maintain the essence and integrity of a system or process at a given scale" (IPCC 2018, p. 542) or transformational and change "the fundamental attributes of a social-ecological system in anticipation of climate change and its impacts" (IPCC 2018, p. 542). Whether it is through hydro-climatic risk management or the development of climate resilience, there are many points of intersection between the two fields.

Moreover, while risk management has long been associated with a rather short time horizon (Thomalla et al. 2006), the conceptual evolution of resilience towards adaptation and anticipation opens the door to longer-term planning, allowing a better linkage with climate change adaptation objectives. For Lama et al. (2017), adaptation and resilience have become complementary objectives to be achieved to reduce vulnerability. However, the relationship between these two concepts is not simple and certain aspects must be considered for risk and sustainable development to ensure that adaptation and resilience are developed and strengthened effectively. These include the importance of making explicit the values, goals, and aspirations that drive the process; the spatial and scalar delineation of the individuals, households, and communities involved and their relationships; and the precise definition of the time period involved (Lama et al. 2017).

Resilience is also intrinsically linked to sustainable development, whether through territorial planning activities, resource management, or vulnerability factors. Sustainable development constitutes "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Imperatives 1987, p. 14). Its process is based on the reconciliation of three basic elements, which are interdependent and all indispensable to the well-being of individuals and societies: economic growth, social inclusion, and environmental protection (United Nations 2021). Sustainable development calls for and promotes the following elements: concerted action; poverty eradication; sustainable, equitable, and inclusive economic growth; creation of opportunities for all; reduction of inequality; improvement of basic living conditions; equitable social development; inclusion; and integrated and sustainable management of natural resources (United Nations 2021). Resilience and sustainable development enjoy a mutually positive relationship. Sustainable development can contribute to economic development activities that consider hazards and help reduce rather than exacerbate risk. In turn, resilience helps protect development efforts and their sustainability. Furthermore, resilience is linked to environmental protection through nature-based solutions and the ecosystem-based approach. For Mabon (2019), post-disaster recovery is an opportunity to reflect on how nature-based solutions can help a community to rebound differently, to build back greener. The ecosystem-based approach is used both in the field of climate change adaptation (ecosystem-based adaptation—EbA) and in the field of disaster risk reduction (Eco-DRR), it gives a central role to ecosystems in adaptation and in disaster risk management. It consists of "the use of biodiversity and ecosystem services as part of an overall adapting strategy to help people adapt to the adverse effects of climate change" (UNDRR 2020, p. 10). This approach thus refers to "the sustainable management, conservation and restoration of ecosystems to reduce disaster risk, with the aim to achieve sustainable and resilient development" (UNDRR 2020, p. 10). The increasing importance of the principle of equity within the concept of resilience also contributes to bringing it closer to the objectives of sustainable development. According to Twigg (2007), the equitable distribution of wealth and assets and an equitable economy are essential to the development of community resilience. Thus, building community resilience should never be about maintaining the status quo, but rather about moving toward more equitable conditions (Cutter 2016; Amobi et al. 2019).

8 Conclusion

Resilience has undeniably become one of the big ideas of our time for dealing with uncertainty (Ruszczyk 2019). Beyond its catchy and all-encompassing nature, the concept is now being used as the basis for reflective decisions and concrete practices (Matyas and Pelling 2015), particularly by local communities. As discussions on resilience in the context of disaster risk, climate change, and sustainable development continue, its conceptualizations have yet to converge into a widely accepted framework (Mochizuki et al. 2018). Concerns and debates remain about its operationalization, effectiveness, and especially about the equity issues associated with it. The great conceptual evolution that resilience has undergone also raises questions. To what extent can a concept evolve, move away from its original meaning, without becoming distorted? Is resilience really the result of the evolution of efforts and the paradigm shift that disaster risk management has undergone in recent decades? Or has resilience reached its limit and are we seeing the emergence of a new, integrative concept?

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