

The contribution of the resilience approach to the governance of complex systems: A qualitative study in the Po delta area, Italy

Arianna Morelli ^{a,*}, Davide Olori ^b, Andrea Taramelli ^{a,c}

^a Istituto Universitario di Studi Superiori di Pavia (School for Advanced Studies) - (IUSS), Palazzo Del Broletto, Piazza Della Vittoria 15, 27100 Pavia, Italy

^b Alma Mater Studiorum - Università di Bologna, Strada Maggiore 45, 40125 Bologna, Italy

^c Istituto Superiore per La Protezione e La Ricerca Ambientale (Institute for Environmental Protection and Research), (ISPRA), Via Vitaliano Brancati 48, 00144, Roma, Italy

ARTICLE INFO

Keywords:

Disaster risk reduction
Resilience-thinking
Governance
Coastal areas
Social-ecological systems
Stakeholders

ABSTRACT

The increase in climate and weather extremes calls for a strengthening of resilience and governance in coastal areas. One of the primary challenges faced by decision-makers, managers, and communities in implementing measures to build disaster-resilient societies is that priorities vary depending on the location and are subject to diverse interpretations. This diversity makes resilience a societal issue, and its operationalization a challenging process.

While the importance of resilience-thinking has gained widespread recognition in coastal management policy, and considerable research has been dedicated to defining the concept, there remains a scarcity of empirical studies delving into the discourse surrounding disaster resilience among stakeholders and its significance in managing complex situations. To effectively integrate resilience into the realm of coastal governance, gaining a better understanding of the concept is necessary. Engaging various actors in the assessment of a system's resilience is vital as it holds the potential to uncover shared solutions.

By employing the Grounded Theory Methodology approach and utilizing the diverse expertise and practical insights of 17 governance actors in the Po Delta in Italy, we identified key factors that should be considered in the policy design when operationalizing coastal resilience, with the notions of stability and transformation envisioned as a central component of the strategy.

1. Introduction

The unprecedented pace of climate change has led to an increase in the frequency and severity of extreme events posing significant challenges for coastal areas (IPCC, 2022; Warddekker et al., 2010) and adversely affecting their capacity to deliver crucial, ecological, economic, social and cultural benefits (Littles et al., 2018).

Effectively addressing such events requires a comprehensive assessment encompassing the severity and frequency of hazards, the number of people and assets exposed to these hazards, their vulnerability to damage (UNISDR, 2015). Additionally, successful navigation through these challenges involves assessing three primary factors: complexity, scientific uncertainty, and socio-political ambiguity (Klinke and Renn, 2012; Aven and Renn, 2009).

In alignment with this perspective, disasters, as highlighted by Lewis (1988), often exhibit a gradual onset when examined within the

framework of local conditions and susceptibility. Within this context, given the inherent complexity of social and ecological systems, it is important to address the reduction of uncertainties (Kinzig et al., 2000) and to acknowledge that predictive models and preventive strategies frequently prove inadequate during the decision-making phase (Lakoff, 2006; Folkers, 2021).

Within this framework, resilience has gained recognition as a relevant concept in the field of coastal management (Portman, 2018; Maselink and Lazarus, 2019), serving as a central focus in both research and policy development across diverse sectors and scales (Bhamra et al., 2011). Evaluating resilience capacity is thus considered a pivotal step toward Disaster Risk Reduction (Burton, 2012), complemented by a governmental approach to resilience (Pellizzoni, 2017).

As society confronts with increasingly complex risks, the governance system experiences an elevated degree of intricacy (Jacobzone et al., 2020), making essential the consideration of a multitude of perspectives

* Corresponding author.

E-mail addresses: arianna.c.morelli@gmail.com (A. Morelli), andrea.taramelli@iusspavia.it (A. Taramelli).

and values held by diverse stakeholders engaged in policy deliberations (De Marchi and Ravetz, 1999). It becomes essential to acknowledge that the actors involved in governing a territory and implementing initiatives for Disaster Risk Reduction and resilience are not external entities but integral components of the system itself. With increasing uncertainty and diverse “legitimate interests”, the formulation of definitive policy recommendations becomes impractical (Funtowicz and Ravetz, 1993). Underlining the pivotal role of a peer community in evaluating the multifaceted aspects of disaster risk proves thus pertinent, leading to a shift towards “post-normal science” (Funtowicz and Ravetz, 2003). However, the practical application of this concept in real-world scenarios remains largely untested. The prevailing body of literature predominantly focuses on the normative question of “how things ought to be” often neglecting to elucidate “how things are” and “why things are the way they are” (Biesbroek et al., 2017, p. 64), engaging stakeholders in empirical works.

Within this context, the inclusion of inputs from local stakeholders in environmental and developmental decision-making is advocated by both international and European frameworks, as exemplified by Article 10 of Directive (2007)/60/EC. Specifically, the significance of involving stakeholders in flood risk management has been highlighted in policy and practical contexts within the European Union, as underscored by Tingsanchali (2012), and Begg et al. (2018).

This study aims to complement the discussion on the operationalization of coastal resilience, as previously addressed by Morelli et al.'s (2021) with the same group of stakeholders. Drawing from recurring themes in a series of semi-structured interviews, our work aims to move beyond the discourse on indicators and delve into the challenge of involving a subjective component delivering insights to guide the operationalization of resilience.

2. Framing resilience, governance and stakeholders' participation

Over time, resilience has been extensively employed to address the intricacies of human-environment interactions (Olsson et al., 2015) and to bridge policy and science domains (Brown, 2016). Its measurement and comprehension have become crucial steps in identifying interventions that can enhance society's ability to cope with adverse events (Béné, 2013). Originally stemming from ecological theory (Holling, 1973), resilience entered sociology and human geography (Tobin and Witheford, 2002; Adger, 2000) in the late 1990s and it was employed to conceptualize complex, adaptive, and transformative social (Adger, 1999, 2000) and socio-ecological systems (Adger et al., 2005; Carpenter et al., 2001; Gunderson, 2010) capable of self-organization and adaptability to changing circumstances (Gunderson and Holling, 2002; Biggs et al., 2015)

Over the years, the concept of resilience has undergone multiple redefinitions due to different epistemological orientations and methodological practices (Rodina et al., 2017; Ziervogel et al., 2017). One key issue has been determining system boundaries and the primary level of analysis for applying resilience, predominantly at the community (Ainuddin and Routray, 2012; Kafle, 2012; Cutter et al., 2014) and systemic levels (Marzi et al., 2019).

The evolution of the meaning of resilience is evident in the definitions provided in IPCC assessment reports. While in 2007, resilience was defined as “the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning” (IPCC, 2007, p. 37), by 2012 and 2014, the concept had expanded to include the enhancement of essential functions and “the ability to anticipate, reduce and accommodate or recover from the effects of a hazardous event in a timely and efficient manner (IPCC, 2012; IPCC et al., 2014, p. 1108).

Resilience has become a multifaceted concept, a feature of the “system that emerges as a result of the ecological, economic, and institutional orders working in conjunction” (Aligica, 2014, p. 102). This

multifaceted nature underscores the need to identify the factors contributing to resilience and how to measure them effectively. However, definitional challenges persist, making its operational use challenging (Alexander, 2013).

The worldwide spread of the resilience approach has not resulted in universal definitions, as practitioners hold distinct viewpoints when adopting a concept tailored to specific contexts (Helfgott, 2018). Determining what is deemed valuable or represents an improvement or drawback depends on the observer's perspective. Changes that benefit one group may potentially harm another, thus characterizing system resilience requires the participation of various stakeholders and experts (Helfgott, 2018). Concerns have been raised by some authors that resilience could potentially turn into an empty notion, serving as an ambiguous term exploited to justify almost any end (Porter and Davoudi, 2012).

In the context of Disaster Risk Reduction, social-ecological resilience encompasses the notions of adaptation and learning to ensure the persistence of essential functions (Prior and Hagmann, 2014; Wardekker et al., 2010; Masson-Delmotte et al., 2018). While some argue that maintaining and enhancing adaptive capacity should be the primary goal of resilience (Klein et al., 2003), others contend that an exclusive focus on adaptation perpetuates the existing order and ignores transformative capacity, which is essential for reshaping Disaster Risk Reduction (Redman, 2014; Manyena et al., 2019). The resilience thinking has been criticized for insufficiently addressing power dynamics and human agency, making the reconciliation of resilience with transformation difficult (Carr, 2019; Matin et al., 2018; Pelling and Manuel Navarrete, 2011). Cannon and Müller-Mahn (2010) have argued that resilience has a potentially problematic aspect as it removes the power dynamics associated with vulnerability. They further assert that the resilience approach might lead to interventions that blur the lines between politics and economics, framing them as impartial aspects of ecosystem management. This shift could downplay the political factors placing people at risk.

Accounting for human agency offers the potential to incorporate the social dimension into resilience (Carr, 2019; Weichselgartner and Kelman, 2015; Kelman et al., 2016) and acknowledges that resilience is a concept charged with political implications and assumptions that require discussion (Pellizzoni et al., 2017a).

Linked to the concept of resilience is preparedness, being prepared is part of the culture of resilience, despite the fact that preparedness maintains its own unique and distinct rationale. In accordance with Lakoff (2006), preparedness is a combination of both a mindset and a collection of strategies for contemplating and intervening in an uncertain and potentially catastrophic future.

The adoption of the resilience paradigm has shifted the focus from environmental determinism to social constructionism (Middleton and O'Keefe, 2006). Disasters are now seen not only as outcomes of hazards but also as manifestations of disequilibrium in land use and social structures, negatively impacting the community's capacity to withstand shocks (Manyena, 2014). Recent examples include intense rainfall events causing flash floods in Liguria Region (Italy) during the autumn of 2011, and extreme storms leading to severe flooding in Italy's Marche (September 2022) and Emilia-Romagna (May 2023) regions.

Resilience has gradually made its way into the political arena, particularly in addressing governance mechanisms (Biesbroek et al., 2017) and it is increasingly considered central in navigating governance complexities (Biesbroek et al., 2017; Walker et al., 2004). Modern governance theory emphasizes the combination of governing efforts, the diversity of roles, institutions, and actors wielding power, as well as the dynamic relationships among them (Kooiman, 2003; Pellizzoni, 2017). Governance is no longer limited to government activities but entails the ability to negotiate and share resources among various actors (Haward and Vince, 2008), with local-level institutions playing a critical role in fostering transformative and adaptive capacity. (Zolli and Healy, 2013; Frankenberger et al., 2013). In this framework local coastal governance

refers to the place-specific political and institutional processes involved in managing coastal areas. It sets the stage for collaborative efforts, involving stakeholders from the government, the private sector and civil society as indicated by Ojwang et al. (2017) and Celliers et al. (2020), integrating multiple values, interests and agendas (Chakraborty et al., 2020). This makes coastal zones complex and contested areas where different uses overlap. Recognizing the importance of coastal governance necessitates acknowledging the diversity of human interactions and perspectives (Partelow et al., 2020).

The International Risk Governance Council (IRGC, 2005) suggests considering resilience as a normative goal for managing complex systems dealing with uncertain events and involving stakeholders (Florin and Parker, 2020; Cadag and Gaillard, 2012). The normative dimension of resilience introduces the notion of desirability and the identification of improvements versus what is considered detrimental. Assessing positive and negative system attributes depends on the observer's perspective (Helfgott, 2018; Walker et al., 2004).

In the context of risk assessment, it's crucial to recognize that human knowledge is inherently partial and incomplete (Funtowicz and Ravetz, 1992; Renn, 2008). Uncertainty introduces subjective judgment, blurring the once-clear line between facts and values, requiring a shared understanding that integrates evidence-based and value-based assertions. The former describes conditions, relationships, and consequences, while the latter offers a vision of how things ought to be (Failing et al., 2007).

Consequently, there is a need for a fresh approach to navigate this ambiguity. Stakeholder participation emerges as a means to gather additional insights that can positively influence decision outcomes, akin to Keck's interpretation of the role of sentinels in identifying emerging risks within the context of preparedness (Keck, 2015, 2020). To ensure that disaster resilience effectively mitigates the increasing risks of disasters, it is essential to elevate the expert perspectives and needs of practitioners in the ongoing discussion (Keating and Hanger-Kopp, 2020).

3. case study: the Po delta

3.1. flood risk governance and coastal management in the area

Italy's recent history has been marked by floods that have resulted in economic, social, and environmental harm. Projections suggest that, in the absence of adaptation measures, flood-related losses could reach 600 million euros annually by 2100 (Carrera et al., 2015).

High-risk areas for hydraulic hazards encompass 5.4% of the national territory, while medium-risk areas make up 10%, and low-risk areas, considering the worst-case scenario, account for 14% (Trigila et al., 2021).

Modern flood risk management in Italy began in 1989 with the adoption of the first law on soil protection (Vitale and Meijerink, 2021). This legislation marked a significant shift by merging two historically distinct domains: hydraulic protection and soil preservation (Gallozzi et al., 2020). It also emphasized the significance of spatial planning measures (Vitale and Meijerink, 2021).

Since 2007, Italy's flood risk policies have increasingly reflected the central government's influence, emphasizing an engineering-focused approach that prioritizes flood control infrastructure (Vitale and Meijerink, 2021). Additionally, emergency management is coordinated with regional governments (Gallozzi et al., 2020). The national Department of Civil Protection, directly overseen by the Prime Minister, has taken on responsibilities related to disaster prevention, forecasting, monitoring, and coordinating response efforts (Legislative Decree No. 1 of 2018: Civil Protection Code).

Simultaneously, the implementation of the EU Water Framework Directive (Directive, 2000/60/EC) and the Floods Directive (Directive, 2007/60/EC) necessitated the coordination of Italy's multi-level water governance, involving national, regional, and local levels, as well as

river basin districts (Alberton, 2021). Law No. 221/2015 established seven Basin District Authorities (Autorità di bacino distrettuale) operating under the coordination, political guidance, and oversight of the Ministry of the Environment. The centralization approach has been reinforced by the composition of the Permanent Institutional Conference (Conferenza istituzionale Permanente), the decision-making body for the Basin District Authorities. This conference includes the Minister of the Environment, the Minister of Transport and Infrastructure, and, in some cases, the Minister of Agriculture and Forests, the Minister of Cultural Activities and Tourism, the Head of the Civil Protection Department, as well as the presidents of the relevant Regions and Autonomous Provinces or their representatives. Within this framework, local stakeholders and local governments are not effectively engaged, presenting a challenge for Italy's water governance (Alberton, 2021).

The initial move toward integrated coastal zone management in Mediterranean countries began with the "Recommendation on the Implementation of Integrated Coastal Zone Management (ICZM) in Europe (2002/413/EC)". While some progress has been made in recent years in implementing this process, it's important to note that the majority of efforts have been regionally or locally oriented, with fewer national-level initiatives (Cantano and Greco, 2023). The European Union introduced a 'Protocol on Integrated Coastal Zone Management in the Mediterranean' in 2009, which has been endorsed by the EU Commission. The document is currently pending ratification by Italy and it outlines a set of principles and objectives that include, among others, the commitment of the involved parties 'to take the necessary measures to ensure the active participation of various stakeholders in the phases of formulating and implementing coastal and marine strategies, plans, programs, or projects, as well as in the issuance of various authorizations' (Article 14 - Protocol on Integrated Coastal Zone Management in the Mediterranean).'

3.2. the study area: the Po delta

The Po Delta, officially designated as a UNESCO Biosphere Reserve in June 2015, represents one of Europe's most densely populated and vital wetlands ecosystems, spanning the Emilia-Romagna and Veneto regions and covering an extensive area of 73,000 ha (Fig. 1). The Delta is relevant on multiple fronts, providing residential, recreational and economic functions, while presenting a complex and dynamic natural system (Corbau et al., 2019; Taramelli et al., 2015).

The area is vulnerable to the impacts of climate change, including sea-level rise and extreme weather events (Taramelli et al., 2020; Torresan et al., 2019). Moreover, the deltaic beaches are characterized by significant erosive phenomena attributed to the substantial reduction in the Po River's sediment load and to the general shoreline retreat between 1945 and the latter half of the 1990s (Bondesan et al., 1995; Taramelli et al., 2015; Taramelli et al., 2018).

The land is used mainly for agriculture followed by viticulture, horticultural cultivation and rice paddies, along with extensive lagoon fish farming, making the region economically significant for Italy (Simeoni and Corbau, 2009; Corbau et al., 2019).

The municipalities encompassed in the area include: Adria, Ariano nel Polesine, Corbola, Loreo, Papozze, Porto Tolle, Porto Viro, Rosolina, Taglio di Po, Alfonsine, Argenta, Cervia, Codigoro, Comacchio, Goro, Mesola, Ostellato, Ravenna. Among these, nine municipalities are situated on the coast (five in the Emilia-Romagna region).

The Veneto and Emilia Romagna regions have established two regional parks, and a significant portion of the Delta's territory has been included in the EU Natura 2000 network for its high natural value. The geographical delta is predominantly located within the Parco Regionale Veneto del Delta del Po, covering an area of 12,000 ha. The historical delta, with a total area of 53,978 ha encompassing the territory between the provinces of Ferrara and Ravenna, forms part of the Parco Delta del Po Emilia-Romagna, extending from the course of the Po di Goro to the Cervia salines.

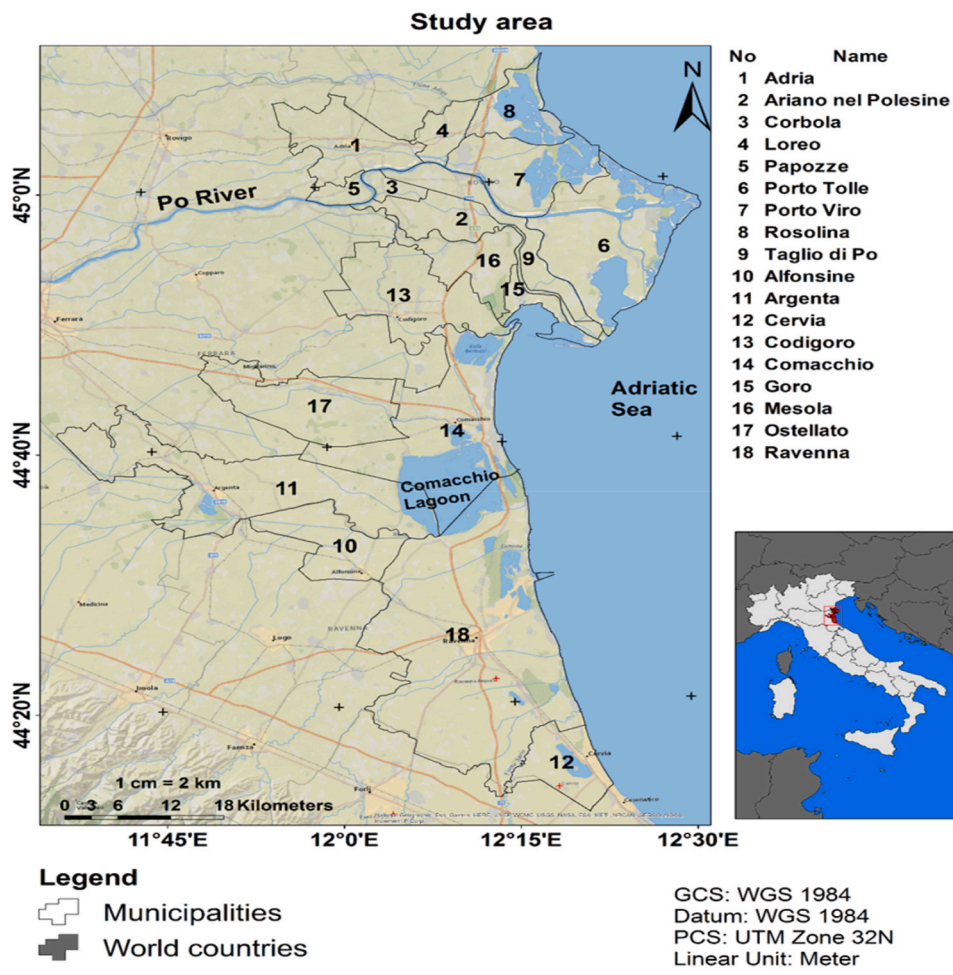


Fig. 1. The Po Delta study area and its municipalities.

Within this area, local stakeholders have actively participated in collaborative approaches, leading to the adoption of the Environmental Plan of the Po Delta Veneto Regional Park in December 2012. Furthermore, they have been engaged in the integrated management of water resources through the efforts of the Po Delta Reclamation Consortium known as the ‘River contract.’ Simultaneously, community policies have been implemented through the Local Actions Groups Polesine Delta del Po (for the Veneto territory) and Delta 2000 (for the Emilia-Romagna area). These groups comprised both public and private entities representing diverse socio-economic interests.

4. materials and methods

4.1. the stakeholders’ semi-structured interviews

Incorporating the concept of resilience into policy discussions introduces complexities tied to deliberations and the trade-offs required in decision-making (Parsons and Thoms, 2018; Parsons et al., 2017). To explore the integration of resilience as a guiding principle in the governance of the region, we conducted a series of semi-structured interviews with a diverse group of stakeholders working for various organizations involved in Disaster Risk Reduction, possessing expertise in coastal governance and local development.

In the stakeholder selection process, we included entities that have been ‘actively involved in managing disasters before, during and after events and whose interests may be negatively affected in consequence of a disaster’ (Mojtahedi and Oo, 2017, 40). Additionally, participants holding key managerial positions and influencing the strategies of the

entities, were included. The seventeen selected interviewees represented their own viewpoints, ensuring a broad spectrum of perspectives and experiences, encompassing aspects from risk management to considerations of economic, environmental, and political dimensions.

The table below provides an overview of the respondents’ institutional affiliations and their respective roles.

We utilized the Grounded Theory Methodology (GTM), a qualitative research approach developed by sociologists Barney G. Glaser and Anselm L. Strauss in the 1960s. GTM aims to construct conceptual frameworks from gathered data. Our data collection began with semi-structured interviews, well suited for delving deeply into information (McNamara, 1999), exploring novel topics (Boyce and Neale, 2006), and constructing knowledge, as emphasized by Kvale and Brinkmann (2009).

The primary objective of the interviews was to gain insight into stakeholders’ perspectives regarding community resilience and governance practices. The interviewees were asked to: i. Define resilience; ii. Identify resilience attributes that positively impact the enhancement of area governance; iii. Highlight local initiatives strengthening resilience against flooding; iv. Discuss the level of coordination among the institutions involved in the governance of the area; v. Identify the main obstacles and challenges experienced in area governance; vi. Describe any participatory processes, if applicable (the specific questions can be found in Annex I).

To facilitate subsequent analysis and comparison, we posed the same semi-structured questions to all interviewees, allowing some flexibility to clarify responses and incorporate emerging knowledge throughout the research process (Charmaz, 2006).

Table 1
List of the interviewed stakeholders, their roles and belonging institutions.

Institution type	People interviewed and role
Consorzio di Bonifica of Veneto Region (Reclamation consortium: in charge of the water management for agricultural irrigation; soil protection; maintenance of the hydraulic infrastructures)	Top management - 1 person
Emilia-Romagna regional coordination office for risk (forecasting and prevention)	Top management - 1 person
Environmental group operating in the Emilia Romagna region	Top management and academic –1 person
Environmental group operating in the Veneto region	Top management and civil servant in a regional authority - 1 person
Trainer of the Civil protection’s volunteers (Emilia-Romagna)	Executive - 1 person
Vice Mayor of one of the municipalities of the Po Delta	1 person
Emilia- Romagna Institute for the cultural heritage and landscape protection	Middle management - 1 person
Emilia-Romagna Regional Agency for Prevention, Environment and Energy - Hidro-Meteo-Climate Department	Top management - 1 person
Research center for the tourism and commerce sectors (working in cooperation with the Italian Enterprise Confederation)	Top management - 1 person
Politician - Member of the Emilia-Romagna legislative assembly	1 person
Local Action Group (GAL) for the valorisation of the Po Delta area (actuator of the Community sectorial policies of the Veneto Region)	Top management - 1 person
Veneto Region - Civil protection – Department for the Emergency Coordination	Top management - 1 person
Veneto Region - Civil protection – Department for Planning	Top management - 1 person
Emilia-Romagna Regional office for Land and Coastal defense	Middle management - 1 person
Emilia-Romagna Regional office for the biodiversity protection	Top management - 1 person
Local Action Group (GAL) for the valorisation of the Po Delta area (actuator of the Community sectorial policies of the Emilia-Romagna Region)	Top management - 1 person
Italian Farmer’s Confederation - Headquarter of the Ferrara Provincial Office	Top management - 1 person

We avoided abstract questions to prevent confusion among participants (Ritchie et al., 2003) aiming for straightforward, concrete questions in everyday language, to yield comprehensive data that could enhance theoretical comprehension (Kvale, 1996).

Seventeen in-depth interviews were conducted and analyzed. Following the principle of data saturation, the point where additional data do not provide any fresh and additional insights, (Guest et al., 2006; Kvale and Brinkmann, 2009; Saunders et al., 2018), we decided to not proceed with more than 17 interviews as the latter ones did not contribute novel perspectives.

Upon collecting and transcribing the semi-structured interviews, we conducted a comprehensive review of all responses to gain a profound understanding of the raw data (Charmaz, 2006; Silverman and Marvasti 2008). In our analytical process, we initially deconstructed the interviews into smaller units, like words or phrases, and assigned descriptive codes to them to identify concepts and patterns without any preconceived ideas. Subsequently, we interrelated these codes and sought connections between concepts, ultimately grouping them into broader categories used as headings in the forthcoming tables.

5. results: the stakeholders’ perspective on coastal resilience and governance

Through the interviews, a substantial amount of valuable information was gathered. The categories derived from the responses are presented in Tables 1–5 and are associated with the stakeholders’ perspectives on the: i. Definition of resilience; ii. Dimensions relevant for achieving resilience and enhancing area governance; iii. Local initiatives enhancing resilience; iv. Level of coordination among the institutions involved in the governance of the area; v. Primary obstacles and challenges encountered in area governance; vi. Presence of participatory processes.

An analysis of the concept of resilience revealed that, according to the respondents, the debate surrounding the term can be recontextualized into two categories: resilience as the capacity to withstand and rebound to previous conditions, thereby favoring existing dynamics (Redman, 2014), and resilience as the capacity to respond, recover, and transform (Cutter et al., 2008; Pfefferbaum et al., 2015).

In Table 2, below, responses have been organized based on the respective categories that emerged from the interviews.

As we progress in examining the perspectives of local stakeholders regarding resilience, we have inquired about the dimensions they deem essential for nurturing resilience and enhancing area governance. These dimensions are envisioned to translate into actionable strategies at the organizational level.

From these discussions, five overarching categories have emerged, as outlined in Table 3.

As the third stage of our investigation, we delved into the existence of local initiatives considered relevant for constructing a resilient community. The responses are detailed in Table 4.

From the respondents, two distinct viewpoints emerged: i. Participants acknowledge the presence of initiatives aimed at fostering

Table 2
Categories and narratives of the term resilience.

Capacity to resist and bounce back to previous conditions	Capacity to respond, recover and transform
<p>“Resilience is the capacity of a territory to resist” (Environmental group operating in the Emilia-Romagna region)</p> <p>“Is the capacity to resist and reorganize also under uncertain conditions” (Vice-Mayor)</p> <p>“Is the capacity to resist to natural events” (Regional agency for Prevention, Environment and Energy)</p> <p>“Resilience means to be able to resist to external stressors also under uncertain conditions” (Regional office for the biodiversity protection)</p>	<p>“Resilience is the capacity to bounce back to the previous condition” (Politician and Representatives of the Local Action Group for the valorisation of the Po Delta area in the Emilia-Romagna region)</p> <p>“Resilience is the ability to return to the starting point conditions” (Italian Farmer’s Confederation)</p> <p>“Resilience means to recover the previous state, it allows to deal with complex problems” (Environmental group operating in the Veneto region)</p> <p>“Ability to adapt to changes and new conditions” (Local Action Group for the valorisation of the Po Delta area in the Veneto region)</p>
	<p>“Is the capacity to respond in an active and transformative way” (Civil protection Department for Planning)</p> <p>“Ability to face Difficulties” (Regional office for Land and Coastal defense)</p> <p>“Ability of a group to face catastrophic events also under uncertainty” (Research center for the tourism and commerce sectors)</p> <p>“Capacity to respond to critical situations with an open approach” (Civil protection Department for the Emergency Coordination)</p>
	<p>“The ability to reorganize and transform” (Institute for the cultural heritage and landscape protection)</p>

Table 3
Dimensions considered relevant for the resilience and governance of the area.

Awareness of risk and preparedness	Socio-economic development	Social cohesion	Diversity of expertise	Organisational actions
<p>“The existence of pre-alert systems” (Regional agency for Prevention, Environment and Energy)</p> <p>“Risk awareness and to know how to behave” (Civil protection - Department for the Emergency Coordination)</p> <p>“The awareness of risk fostered through moments of information and training” (Regional office for Land and Coastal defense)</p>	<p>“The population’s know-how and the strengthening of skills able to promote the socio-economic development are fundamental for building a resilient community and improving the governance of the area” (Vice Mayor)</p> <p>“The cultural dimension is central to fostering a resilient community with a consequent positive effect on the governance of the area” (Local Action Group for the valorisation of the Po Delta area in the Emilia-Romagna region)</p> <p>“We need life-long learning education for promoting the social-economic development of the area with a consequent positive effect on the governance of the area from a disaster risk reduction perspective” (Environmental group operating in the Emilia-Romagna region)</p>	<p>“Social ties, networks and the active participation of citizens to the activities present in their territory are important to build resilience and benefit also the governance responses” (Civil protection - Department for Planning)</p> <p>“The population’s ties and cohesion” (Environmental group operating in the Veneto region)</p> <p>“Sense of belonging and knowledge of the territory are important drivers of resilience and central aspects to address the problems faced in the governance of the area” (Civil protection - Department for the Emergency Coordination)</p> <p>“Inhabitants’ knowledge of the territory and its features” (Vice Mayor)</p> <p>“Sense of belonging, local identity and strong tie connection with the environment” (Politician)</p> <p>“People and population must be involved in the management of their territory, this has a positive effect on the enhancement of resilience as well as on the governance” (Regional office for biodiversity protection)</p> <p>“The presence of the population is central to guarantee the territory’s resilience, in this sense an agriculture that wants to preserve the landscape is particularly important, we must avoid the overbuilding and pay attention to the planning rules which affect the spatial, socio-economic characteristics and adaptation capacities of an area” (Italian Farmer’s Confederation)</p>	<p>“We need a multidisciplinary debate, different competencies working together, a mosaic is more resilient than a slab, local actors should work with each other and share the different expertise, this has a positive effect on resilience and governance of the area” (Environmental group operating in the Emilia-Romagna)</p> <p>“The economic diversification, if the economy of a territory is based on a single sector and this undergoes a crisis, it is a social tragedy and the risk is to assist to a progressive depopulation” (Local Action Group operating in Emilia-Romagna)</p> <p>“The economic diversification is central to keeping a territory alive” (Research center for the tourism and commerce sectors)</p>	<p>“To build a resilient community the allocation of dedicated resources by institutions is central” (Environmental group operating in the Emilia-Romagna)</p> <p>“It is necessary to act in a coordinated manner” (Local Action group operating in Veneto region)</p> <p>“the resilience issue must be faced with an organizational approach and dedicated resources” (Trainer of the Civil protection’s volunteers)</p> <p>“ad hoc public investments are needed” (Italian Farmer’s Confederation)</p>

dialogue, empowering citizens, and mitigating risks, thereby being seen as contributing to the development of a resilient community; ii. Participants express concerns about the lack of initiatives focused on promoting resilience. In this regard, grassroots environmental groups in the Veneto and Emilia-Romagna regions highlighted issues such as insufficient attention to biodiversity preservation, hydraulic interventions favoring the fishing sector without a long-term vision, and a lack of institutional capacity for integrated action. Prioritizing climate change and resilience in the political agenda was also identified as a gap. This perspective was echoed by the Italian Farmer’s Confederation representative, emphasizing resource limitations and interventions primarily focused on the emergency phase. Additionally, concerns about land consumption and its adverse impact on constructing a resilient community were particularly emphasized by four respondents. The interviewee from the Civil Protection Department for Planning stated: “Political initiatives at the social and economic levels should be informed by an awareness of the risks present in the territory. Unfortunately, politicians continue to consume the land, despite our repeated warnings that this area faces a hydraulic risk”. The respondent from the Emilia-Romagna regional agency for Prevention, Environment and Energy along with the one from the Emilia-Romagna regional coordination office for risk forecasting and prevention, expressed similar views: “The recent regional law on land-use planning does not align with the

objective of building a resilient community”; “The regional law on land-use is moving in the opposite direction of creating a resilient territory.” Lastly a trainer of the Civil Protection’s volunteers remarked: “There is more emphasis on new buildings, even though nobody is purchasing these houses, rather than maintaining hydraulic infrastructures.”

The categories arising from the responses provided by participants who recognized the presence of initiatives are detailed in [Table 4](#).

The fourth and fifth sections of the interviews were dedicated to understanding the governance of the area through the lens of resilience and exploring the intricacies within its processes. This investigation aimed to uncover aspects deemed essential for enhancing the resilience of socio-ecological systems, focusing particularly on institutional coordination, potential bottlenecks, and the participation and co-production of collective decisions.

It is important to note that all respondents held leadership positions, providing them with profound insights into inter-institutional dynamics.

To evaluate the level of coordination among the institutions operating in the area, interviewees were asked to rate it using a Likert scale, offering options such as ‘inadequate,’ ‘sufficient,’ ‘adequate,’ ‘good,’ and ‘optimal.’ The majority of interviewees regarded the coordination as ‘adequate’ or ‘sufficient.’ Notably, none selected ‘good’ or ‘optimal,’ and only a few provided explanations for their choices. Respondents who elaborated on their choices expressed particular criticism concerning the

Table 4
Local initiatives relevant to building a resilient community.

Empowerment and dialogue	Risk knowledge and mitigation
<p>“There are local initiatives dedicated to informing and raising awareness among the public about the significance of their local environment. This information-sharing serves as a means to empower individuals. It is important to note that the Po Delta area is not a natural landscape; rather, it is a product of human activity” (Institute for the cultural heritage and landscape protection)</p> <p>“The constant dialogue among local stakeholders. One example of successful dialogue is represented by the path that led to the recognition by MAB-UNESCO of the Po Delta Biosphere Reserve” (Action Group for the Local development in the Veneto region and Politician Member of the Emilia-Romagna legislative assembly)</p> <p>“Cooperation among the actors in the area: in one of the municipalities, schools together with the university have proposed a project for the requalification of a neighborhood” (Research Center for Tourism and Commerce)</p> <p>“The River Mouth Contract, a voluntary agreement entered into by local stakeholders and the institutions operating within the same area, enabled the adoption of a range of solutions where public benefit, economic viability, social significance, and environmental sustainability took center stage” (Reclamation consortium)</p>	<p>“The interventions on rivers banks contribute to foster resilience” (Civil protection – Department for Emergency and Coordination)</p> <p>“Efficient management of the hydraulic aspects in the region plays a pivotal role in building a resilient community (Reclamation consortium)</p> <p>“After the implementation of the Floods Directive, various activities have been organized to raise awareness of risk within the municipalities.” (Vice Mayor)</p> <p>“Civil protection initiatives targeting schools have been carried out” (Office for Land and Coastal defence)</p>

institutional coordination level. A significant issue highlighted was the fragmentation in the area’s governance, posing challenges not only in day-to-day administration but also during emergency scenarios. Interviewees emphasized the involvement of two distinct Natural Parks, each adhering to different rules, policies, and priorities, alongside other organizations such as municipalities, all struggling with coordination issues.

The lack of a satisfactory level of coordination underscores various weaknesses pinpointed by the interviewees: i. Short-term political objectives; ii. Insufficient resources for managing emergencies; iii. Institutional fragmentation, along with inadequate communication and collaboration; iv. The geographical characteristics of the area.

All these factors are perceived as impediments to formulating a strategy aimed at fostering a resilient community and enabling comprehensive decision-making across the system.

Table 5 below presents an overview of responses for each category.

The sixth and final aspect under investigation revolves around participatory processes within the area. Responses can be categorized into two groups: i. effective participation; ii. symbolic participation. These delineations are outlined in Table 6 below.

Broadly, interviewees express criticism and highlight the limited engagement of local communities, primarily attributed to the perceived lack of sincere interest among institutional actors. Citizen participation, interaction with authorities, and their influence on decision-making are viewed as limited, with actions primarily determined by institutional actors.

6. Discussion

The formulation of policies involves complex processes

Table 5
The table illustrates the categories related to the identified weaknesses.

Short-term political goals	Lack of resources	Fragmentation	The Physical characteristics of the area
<p>“There are no policy plans that incorporate medium and long-term objectives. The political landscape lacks a forward-looking perspective” (Trainer of the Civil protection’s volunteers)</p> <p>“There is not enough planning, also in the emergency sphere” (Civil protection – Department for Planning)</p>	<p>“There is an insufficient allocation of resources to translate emergency plans into actionable initiatives. Building resilience necessitates the transformation of resilience concepts into tangible actions”. (Reclamation consortium)</p> <p>“We have the emergency plans, but most of the municipalities do not have adequate resources and technical staff to implement them” (Civil Protection)</p> <p>“If I have a monitoring system, without maintenance, the monitoring system is not resilient. Resources are lacking, the construction of a resilient community depends also on the monitoring you are able to carry out” (Regional Agency for Prevention, Environment, Energy)</p> <p>“There is a concern regarding the communication of risk to citizens. There are no clearly allocated resources or guidelines specifying institutional responsibilities. While there is a procedure in place, there is a lack of clarity on its implementation” (Civil Protection – Emergency Coordination)</p>	<p>“It is difficult to create opportunities for real cooperation and networking, even though there is a common environmental and tourism vocation” (Vice Mayor)</p> <p>“The fragmentation of the area among several institutions with a poorly coordinated communication makes it difficult to put in place a real and common strategy” (Institute for the Cultural Heritage and Landscape Protection)</p> <p>“The area is fragmented among several institutions with poor communication, this represents the main bottleneck. According to my opinion the municipalities should be grouped in a network” (Research Center for Tourism and Commerce)</p> <p>“Fragmentation is a weakness. There is a lack of technical staff, as well as poor interinstitutional communication” (Regional office for the biodiversity protection)</p> <p>“In the area we have institutions such as natural parks that follow their own strategy and do not really share a common vision” (Italian Farmer’s Confederation)</p>	<p>“To me a bottleneck is represented by the physical features of that area, being a large part below the sea level” (Regional office for land and coastal defense)</p> <p>“This is a very remote area, difficult to reach, the management is therefore complicated” (Environmental group operating in the Emilia-Romagna region)</p> <p>“These territories are remote, not easy to reach, it is difficult to promote an economic development, in the long period the risk is depopulation” (Local Action groups operating in the Veneto and Emilia-Romagna regions)</p>

encompassing diverse aspects, including political, institutional, stakeholder, and community dimensions (Orach and Schlüter, 2016). In an uncertain and constantly evolving world, the adoption of a resilience approach is gaining prominence as a guiding principle in public policy (Parsons and Thoms, 2018). Resilience underscores humans’ capacity to

Table 6
The participatory processes in the area.

Good participatory process	Symbolic participation
<p>“The two deltas are MAB UNESCO biosphere, this means to have participatory processes in place” (Civil Protection)</p> <p>“Through the ‘River contract’ stakeholders have been involved and been very collaborative (Reclamation consortium)</p> <p>“The participatory process in our territory is very strong” (Vice Mayor)</p> <p>“At the national and regional levels, we conduct risk awareness campaigns targeted at the general public” (Agency for Planning, Environment and Energy)</p> <p>“The candidacy of the Po Delta at UNESCO’s biosphere has represented an important moment of participation, although it was not related to resilience in a strict sense” (Politician)</p> <p>“I am aware of the existence of a regional law that is important to promote a good public participation, but I am not able to provide any practical example” (Institute for Culture and Nature preservation)</p>	<p>“The regional law concerning parks and nature conservation envisions a more proactive engagement of citizens, but this remains largely theoretical. There is a tendency to include only those stakeholders who hold more influence, particularly from an economic standpoint” (Environmental group operating in the Veneto region)</p> <p>“Participation exists primarily in theory. For instance, if we consider the Strategic Environmental Assessment (Valutazione Ambientale), it includes provisions for participatory elements. However, the meetings are scheduled on days and at times when people are at work, making it virtually impossible for them to attend.” (Environmental group operating in the Emilia-Romagna region)</p> <p>“Public participation is a mandatory requirement of the EU Floods Directive. Nevertheless, despite our efforts to organize meetings to encourage interaction with both local authorities and the public, only a limited number of individuals typically attended. Administrators often show interest in participating only when they are aware that the Directive imposes certain urban planning restrictions.” (Civil protection – Department for Planning)</p> <p>“Participatory processes may be in vogue, but their outcomes are seldom utilized, and they lack significant influence in the decision-making process” (Local Action Group operating in the Emilia-Romagna region)</p> <p>“In the past, participatory processes held more prominence, but nowadays, they have diminished at all levels. (Research center for the tourism and commerce sectors).</p> <p>“Politics often adopts a short-term perspective, prioritizing major projects over smaller yet critical interventions that require genuine participation” (Italian Farmer’s Confederation)</p> <p>“Stakeholders are engaged, but the ultimate decision rests with policy makers” (Regional Center for Bio-conservation)</p>

anticipate and shape future trajectories, emphasizing the importance of defining principles, capabilities, and attributes that can inform local governance mechanisms and development strategies. However, integrating this approach into policy initiatives remains challenging. Hence, the primary objective of this study has been to take a step further in understanding how the application of resilience-thinking can enhance coastal governance, employing the Po Delta area as an illustrative context.

Our investigation has raised several important issues within the realm of resilience. Primarily, among stakeholders, diverse interpretations of resilience exist, underscoring that the application of “resilience theory” remains an ongoing subject of debate (Olsson et al., 2015). While some stakeholders perceive resilience as the ability to rebound or withstand an event (Walker et al., 2004; Zhou et al., 2010), others conceptualize it as a proactive notion linked to the capacity to respond, recover, and transform, implying changes in the previous state (Cardona, 2003; Klein et al., 2003; Pelling, 2003; Rose, 2004; Cutter et al., 2008). Despite these diverse definitions, interviewees consider resilience-thinking a valuable approach for addressing complexity and

uncertainty, thereby fostering the development of adaptable and transformative policies when necessary (Wilson et al., 2013).

Concerning the factors that are considered desirable for enhancing resilience and the governance of the area, interviewees have identified the following elements: improved risk awareness and preparedness; enhancement of the socio-economic aspects; promotion of social cohesion and territorial knowledge; increasing economic variety; institutional coordination.

Our findings emphasize the significance of acknowledging the dimensions considered relevant for fostering resilience-thinking within local governance. By prioritizing proactive measures, resilience can be perceived not merely as the sum of a system’s properties but as an ongoing learning process and outcome (Moser et al., 2019), comprising a series of initiatives to be implemented (Fallon et al., 2022). The identified drivers provide a foundational basis for shaping policies and programs, serving as a guiding framework for diverse activities, assessments, communication endeavours, and evaluations. These principles, characteristics, and capabilities can be regarded as provisional frameworks, tested through their implementation in a variety of policy and program contexts (Parsons and Thoms, 2018).

Similarly, our work highlights the challenge of operationalizing resilience in the area. Despite the acknowledgement of the concept as a fundamental principle in coastal management, its translation into tangible actions is considered limited or absent. Respondents held divided views with some recognizing initiatives aimed at empowering the community and mitigating risks and thereby contributing to build resilience, while others emphasized the absence of such efforts. Both groups noted the lack of formal integration of resilience into the political agenda and public policy initiatives. This outcome reinforces the idea that enhancing resilience in practice needs the development of context-based metrics (Townend et al., 2021) and the use of the “resilience” label to clearly allocate financial resources, align objectives, and establish a new realm of action (Grodal, 2007; Bartley, 2007). In our case study, these metrics could be exemplified by the 41 variables identified by the same group of stakeholders involved in this study, as previously discussed in Morelli et al. (2021).

Furthermore, despite the acknowledgement in the literature of collaborative processes as crucial for operationalizing resilience (Rodina, 2019), our findings shed light on the absence of collaboration in the decision-making process within the examined context. A significant observation from our study is that while coordination among organizations involved in the governance of the area is considered sufficient, it never reaches a level described as “good” or “optimal.” Interviewees perceive this as problematic, especially concerning emergency management. Concerns were raised regarding insufficient coordination and allocated resources for emergency plans and infrastructure maintenance. Multiple respondents highlighted the significance of the emergency aspect, emphasizing a risk-based perspective on resilience that concentrates on the system’s ability to absorb the consequences of a shock. The distinction between risk-based and resilience-based approaches, each with its temporal horizon, holds policy implications as they address complementary yet distinct requirements for system assessment and preservation (Linkov and Trump, 2019). This underscores the importance of paying closer attention to the values and narratives that influence institutional work and foster a shared perspective (Coaffee and Clarke, 2015; Bohnsack et al., 2016; Beunen et al., 2017). The reconfiguration of institutional relationships through cooperation, networks, participation, trust, and reciprocity (Ifejika-Speranza et al., 2014) thus emerges as central.

Moreover, interviewees reiterated their concern, underscoring the significance of the emergency phase and the limited resources allocated to address this aspect. This emphasis on the ability to absorb shocks indicates that the practical application of resilience-thinking, with all its facets, in local disaster governance is not straightforward.

Lastly, resilience inherently involves participation and trust, particularly within governance contexts. Participation has the potential to

accelerate learning and bolster resilience (Djalante et al., 2011). As highlighted by Schmidt et al., in 2014, cultivating trust stands as one of the most effective and critical components of participatory processes. However, despite interviewees underscoring the importance of diverse actors engaging to enhance governance, they express substantial skepticism regarding the efficacy of the instituted participatory processes within the area. The marginalization of inclusion and democratic participation emerges as a recurring issue in governance, and extensive research indicates that, even when terms like “participation” are emphasized, citizens may not necessarily experience a concurrent increase in influence (Bifulco, 2017).

The elements identified as pertinent and pivotal for shaping and implementing resilience-based policies are represented in Fig. 2.

The scarcity of resources allocated to monitoring systems and emergency plans, driven by short-term political objectives and the geographical features of the area (central to the territory safeguarding), are identified as the primary obstacles to fostering resilience. Cumulatively, these factors, alongside the importance attributed by the interviewees to aspects such as enhanced risk awareness, social cohesion, institutional cooperation, and participatory processes, emphasize the significance of preparedness in shaping resilient systems (Masten and Obradovic, 2008). This requires conceiving preparedness as the outcome of actions motivated by societal and ecological care, rooted in the acknowledgement and preservation of fundamental interconnections as they manifest in territorially unique contexts (Bifulco, 2017). Achieving this demand “a shift from the short temporality of emergencies to the long temporality of ecologies” (Keck, 2020 p. 177).

Determining who will be responsible for negotiating and establishing desirable outcomes, identifying the beneficiaries, and delineating the boundaries of the system in question, presents interesting challenges in the operationalization of resilience. (Mikkelsen, 2005).

The strategy for shaping a resilient community through policy design would diverge depending on whether resilience is understood as a return to the previous state or as the capacity for transformation. As evident from the interviews, an ongoing and unresolved dilemma exists regarding the management of socio-ecological systems, emphasizing either “stabilization”, which operates within a short to medium temporal scale, or “transformation” dealing with long term prospects. The act of bouncing back and immobilizing the system through stabilization restricts the potential for significant change (Dornelles et al., 2020) and it proposes employing strategies that aim to restore similar conditions

following a disaster, often disregarding opportunities for enhancement or progress (Aldunce et al., 2014).

A pivotal consideration revolves around which elements of the system ought to remain constant and which are open to change, along with discerning which changes are considered an improvement (Helfgott, 2018).

Within this framework, prioritizing components such as monitoring systems, hydraulic intervention, and emergency plans, as recommended by some interviewees in the case of the Po Delta, heavily emphasizes resilience as the ability to swiftly act, resist and restore a previous state. This validates the adoption of rapid policies diminishing the opportunity to reassess and transform territorial systems, thereby neglecting the socio-economic dimensions of resilience.

This approach is opposed to conceptualizing resilience as a transformative process that embraces the involvement of communities. Emphasizing the significance of social cohesion and socio-economic development, as recommended by certain respondents, underscores the pivotal role of the social dimension. Aspects like participation and connectivity, significantly contribute to the construction of resilience (Gunderson and Folke, 2005; Norris et al., 2008).

However, in order to purposefully make transformative changes, possessing a clear guiding perspective and establishing goals within governance processes (Abson et al., 2014; Spangenberg et al., 2015), and consequently formulating socially acceptable visions for the future becomes imperative (Rölfer et al., 2022).

Interestingly, cooperation and participation emerged from the case study as relevant yet challenging aspects to prioritize in the local coastal resilience debate and the transformative processes. Interviewees highlighted the need to diminish fragmentation and involve all interests significantly as indicated in the following illustrative quotes: “The regional law concerning parks and nature conservation envisions a more proactive engagement of citizens, but this remains largely theoretical. There is a tendency to include only those stakeholders who hold more influence, particularly from an economic standpoint”; “We need to support and empower local communities”; “The fragmentation of the area among several institutions with a poorly coordinated communication makes it difficult to put in place a real and common strategy”. This resonates with the findings of Boyes and Elliott (2014) and observations by Nursey-Bray et al. (2014) concerning the decentralization often witnessed by governance systems and the fragmentation of management activities due to divergent interests among stakeholders.

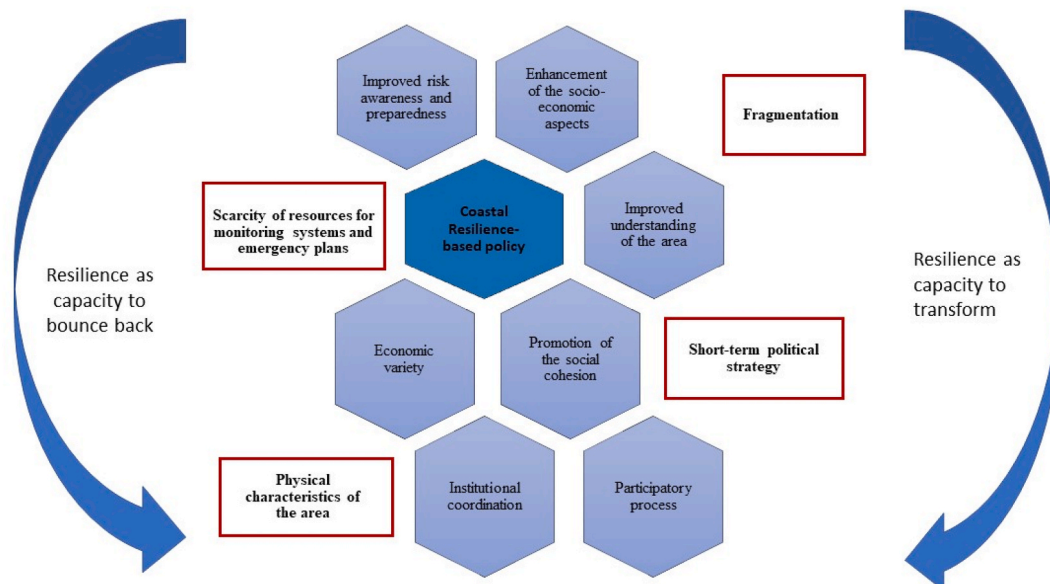


Fig. 2. Elements to consider when designing and implementing resilience informed policy and governance.

7. conclusion

The challenges posed by climate change and its disruptive effects are growing, calling for a deeper understanding of complex coastal systems and the dynamics of human governance.

Through a comparative analysis of stakeholders' perspectives, the thematic findings delineated in this work offer insights and serve as a lens for shaping resilience-based coastal policies. This occurs while acknowledging the difficulties inherent in applying such an approach to a dynamic, unpredictable, and unfamiliar world.

This endeavor involves nurturing participatory processes and institutional cooperation to advocate for long-term-focused policies. Hence, establishing a collaborative space for discussions becomes crucial to cultivating trust, facilitating learning, and establishing networks supporting the implementation of flexible and adaptable governance measures aimed at building resilience.

The adoption of a coastal resilience-based approach necessitates a robust commitment of national, regional and local authorities in fostering democratic empowerment processes.

Employing collaborative management strategies to align socio-economic systems with environmental and technical decision-making stands as imperative. Simultaneously adopting a narrative that values local perspectives, and empowers smaller geographic scales is essential for catalyzing significant change.

CRedit authorship contribution statement

Arianna Morelli: Writing – review & editing, Writing – original draft, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Davide Olori:** Methodology. **Andrea Taramelli:** Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

Acknowledgements

The authors gratefully acknowledge the comments provided by Dr Francesco Maria Sabatini during the revision of the manuscript. Thanks to our interviewees for sharing their knowledge and experience. We gratefully acknowledge the insights provided by Professor Silvana Di Sabatino during the revision phase.

APPENDIX I. SCOPING INTERVIEW FORMAT

1. How would you define resilience?
2. According to your opinion what are the resilience drivers having a positive effect on the improvement of the governance of the area?
3. Are there measures and initiatives put in place by local organizations whose effect is to foster the resilience of the Po Delta Area? May I ask you to provide me with some examples?
4. Using a Likert scale, may I ask to indicate how do you consider the level of coordination among the institutions operating in the area?
5. According to your opinion, what are the main bottlenecks and crucial problems that are experienced in the governance of the area? May I ask you to provide me with some examples?
6. Is there a participative process in the area? May I ask you to provide me with some examples?

References

- Abson, D.J., Von Wehrden, H., Baumgärtner, S., Fischer, J., Hanspach, J., Härdtle, W., et al., 2014. Ecosystem services as a boundary object for sustainability. *Ecol. Econ.* 103, 29–37.
- Adger, W.N., 1999. Social vulnerability to climate change and extremes in coastal Vietnam. *World Dev.* 27 (2), 249–269.
- Adger, N.W., 2000. Social and ecological resilience: are they related? *Prog. Hum. Geogr.* 24 (3), 347–364.
- Adger, N.W., Hughes, T.P., Folke, C., Carpenter, S.R., Rockstro, J., 2005. Social-ecological resilience to coastal disasters. *Sci. Nourishment* 309, 10–36.
- Ainuddin, S., Routray, J.K., 2012. Earthquake hazards and community resilience in Baluchistan. *Nat. Hazards* 63 (2), 909–937.
- Alberton, M., 2021. Water governance in Italy: from fragmentation to coherence through coordination attempts. In: Turrini, P., Massarutto, A., Pertile, M., de Carli, A. (Eds.), *Water Law, Policy and Economics in Italy*, Global Issues in Water Policy, 28. Springer, Cham.
- Aldunce, P., Beilin, R., Handmer, J., Howden, M., 2014. Framing disaster resilience: the implications of the diverse conceptualisations of “bouncing back”. *Disaster Prev. Manag.* 23 (3), 252–270.
- Alexander, D.E., 2013. Resilience and disaster risk reduction: an etymological journey. *Nat. Hazards Earth Syst. Sci.* 13, 2707–2716.
- Aligica, P.D., 2014. “Institutional Resilience and Institutional Theory”. Oxford Scholarship Online.
- Aven, T., Renn, O., 2009. On risk defined as an event where the outcome is uncertain. *J. Risk Res.* 12, 2009 (– 1).
- Bartley, T., 2007. How foundations shape social movements: the construction of an organizational field and the rise of forest certification. *Soc. Probl.* 54 (No3), 229–255.
- Begg, C., Callsen, I., Kuhlicke, C., Kelman, I., 2018. The role of local stakeholder participation in flood defense decisions in the United Kingdom and Germany. *J. Flood Risk Manag.* 11 (2), 180–190.
- Béné, C., 2013. Towards a quantifiable measure of resilience. *IDS Working Papers* 2013 (434), 1–27.
- Beunen, R., Patterson, J., Van Assche, K., 2017. Governing for resilience: the role of institutional work. *Curr. Opin. Environ. Sustain.* 28, 10–16.
- Bhamra, R., Dani, S., Burnard, K., 2011. Resilience: the concept, a literature review and future directions. *Int. J. Prod. Res.* 49 (2011), 5375–5393.
- Biesbroek, R., Dupuis, J., Wellstead, A., 2017. Explaining through causal mechanisms: resilience and governance of social–ecological systems. *Curr. Opin. Environ. Sustain.* 28, 64–70.
- Bifulco, L., 2017. *Social Policies and Public Action*. Routledge, London. <https://doi.org/10.4324/9781315609577>.
- Biggs, R., Schlüter, M., Schoon, M.L. (Eds.), 2015. *Principles for Building Resilience: Sustaining Ecosystem Services in Social-Ecological Systems*. Cambridge University Press, Cambridge.
- Bohnsack, R., Pinkse, J., Waelpoel, A., 2016. The institutional evolution process of the global solar industry: the role of public and private actors in creating institutional shifts. *Environ. Innov. Soc. Transit.* 20, 16–32.
- Bondesan, M., Castiglioni, G.B., Elmi, C., Gabbianelli, G., Marocco, R., Pirazzoli, F.A., Tomasin, A., 1995. Coastal areas at risk from storm surges and sea-level rise in Northeastern Italy. *J. Coast Res.* 11 (4), 1354–1379.
- Boyce, C., Neale, P., 2006. *Conducting In-Depth Interviews: A Guide for Designing and Conducting In-Depth Interviews for Evaluation Input*, 2. Pathfinder international, Watertown, MA.
- Boyes, S.J., Elliott, M., 2014. Marine legislation—The ultimate ‘horrendogram’: international law, European directives & national implementation. *Mar. Pollut. Bull.* 86 (1–2), 39–47.
- Brown, K., 2016. *Resilience, Development and Global Change*. Routledge, London.
- Burton, C.G., 2012. *The Development of Metrics for Community Resilience to Natural Disasters*. Dissertation, University of South Carolina, US.
- Cadag, J.R.D., Gaillard, J.C., 2012. Integrating knowledge and actions in disaster risk reduction: the contribution of participatory mapping. *Area* 44 (1), 100–109.
- Cannon, T., Müller-Mahn, D., 2010. Vulnerability, resilience and development discourses in context of climate change. *Nat. Hazards* 55 (3), 621–635.
- Cantasano, N., Greco, S., 2023. How to solve the gap between science and policy in the coastal management of mediterranean countries. *Journal ISSN* 2766, 2276.
- Cardona, O.D., 2003. *The Notions of Disaster Risk: Conceptual Framework for Integrated Management*. Inter-American Development Bank, Manizales, Colombia.
- Carpenter, S.R., Walker, B.H., Anderies, J.M., Abel, N., 2001. From metaphor to measurement: resilience of what to what? *Ecosystems* 4, 765–781.
- Carr, E.R., 2019. Properties and projects: reconciling resilience and transformation for adaptation and development. *World Dev.* 122, 70–84.
- Carrera, L., Stuardi, G., Koks, E.E., Feyen, L., Mysiak, J., Aerts, J., Bosello, F., 2015. *Economics of Flood Risk in Italy under Current and Future Climate*. CMCC Research Paper, RP0272.
- Celliers, L., Rosendo, S., Costa, M.M., Ojwang, L., Carmona, M., Obura, D., 2020. A Capital Approach for Assessing Local Coastal Governance, 183. *Ocean & Coastal Management*, 104996.
- Chakraborty, S., Gasparatos, A., Blasiak, R., 2020. Multiple values for the management and sustainable use of coastal and marine ecosystem services. *Ecosyst. Serv.* 41, 101047.
- Charmaz, K., 2006. *Constructing Grounded Theory: A Practical Guide through Qualitative Analysis*. sage.
- Coaffee, J., Clarke, J., 2015. On securing the generational challenge of urban resilience. *Town Plan. Rev.* 86, 249–255. <https://doi.org/10.3828/tpr.2015.16>.

- Corbau, C., Simeoni, U., Zoccarato, C., Mantovani, G., Teatini, P., 2019. Coupling land use evolution and subsidence in the Po Delta, Italy: revising the past occurrence and prospecting the future management challenges. *Sci. Total Environ.* 654, 1196–1208.
- Cutter, S.L., Barnes, L., Berry, M., Burton, C.G., Evans, E., Tate, E.C., Webb, J., 2008. Community and Regional Resilience: Perspectives from Hazards, Disasters, and Emergency Management. CARRI Research Report No 1. Community and Regional Resilience Institute.
- Cutter, S.L., Ash, K.D., Christopher, E.T., 2014. The geographies of community disaster resilience. *Global Environ. Change* 29, 65–77.
- De Marchi, B., Ravetz, J., 1999. Risk management and governance: a post-normal science approach. *Futures* 31, 743–757.
- Djalante, R., Holley, C., Thomalla, F., 2011. Adaptive governance and managing resilience to natural hazards. *International Journal of Disaster Risk Science* 2 (4), 1–14.
- Dornelles, A.Z., Boyd, E., Nunes, R.J., Asquith, M., Boonstra, W.J., Delabre, I., et al., 2020. Towards a bridging concept for undesirable resilience in social-ecological systems. *Global Sustainability* 3, e20.
- EC, 2002. Council Recommendation of the European Parliament and of the Council of 30 May Concerning the Implementation of Integrated Coastal Zone Management in Europe (2002/413/EC) European Commission (EC), Brussels L 148/24.
- European Union (Eu), 2009. Protocol on integrated coastal zone management in the mediterranean. Official Journal of European Union. Luxembourg. 19–28.
- Failing, L., Gregory, R., Harstone, M., 2007. Integrating science and local knowledge in environmental risk management: a decision-focused approach. *Ecol. Econ.* 64, 47–64.
- Fallon, A., Jones, R.W., Keskinen, M., 2022. Bringing resilience-thinking into water governance: two illustrative case studies from South Africa and Cambodia. *Global Environ. Change* 75, 102542.
- Florin, M.V., Parker, S.D., 2020. Involving Stakeholders in the Risk Governance Process (No. REP WORK). EPFL International Risk Governance Center.
- Folkers, A., 2021. Preventing the unpreventable. *Catastrophe thresholds from covid to climate. Sociologica* 15 (3), 85–106.
- Frankenberger, T., Mueller, M., Spangler, T., October, Alexander S., 2013. Community resilience: conceptual framework and measurement feed the future learning agenda. Study, USAID.
- Funtowicz, S.O., Ravetz, J.R., 1992. Risk Management as a Postnormal Science.
- Funtowicz, S.O., Ravetz, J.R., 1993. Science for the post-normal age. *Futures* 25 (7), 739–755.
- Funtowicz, S.O., Ravetz, J.R., 2003. Post-normal science. In: *International Society for Ecological Economics. Online Encyclopedia.*
- Gallozzi, P., Dessì, B., Iadanza, C., Guarneri, E.M., Marasciulo, T., Miscione, F., Spizzichino, D., Rischia, I., Trigila, A., 2020. ReNDiS 2020. Twenty years of ISPRA monitoring interventions of soil defence for landslide and flood risk mitigation [ReNDiS 2020. La difesa del suolo in vent'anni di monitoraggio ISPRA sugli interventi per la mitigazione del rischio idrogeologico]. ISPRA.
- Grodal, S., 2007. The Emergence of a New Organizational Field: Labels, Meaning and Emotions in Nanotechnology. Doctoral dissertation, Stanford University.
- Guest, G., Bunce, A., Johnson, L., 2006. How many interviews are enough? An experiment with data saturation and variability. *Field Methods* 18 (1), 59–82.
- Gunderson, L.H., 2010. Ecological and human community resilience in response to natural disasters. *Ecol. Soc.* 15 (2).
- Gunderson, L., Folke, C., 2005. Resilience – now more than ever (editorial). *Ecology and Society & Natural Resources* 10 (2), 22.
- Gunderson, L.H., Holling, C.S. (Eds.), 2002. *Panarchy: Understanding Transformations in Human and Natural Systems.* Island Press, Washington, DC.
- Haward, M.G., Vince, J., 2008. *Oceans Governance in the Twenty-First Century: Managing the Blue Planet.* Edward Elgar Publishing.
- Helfgott, A., 2018. Operationalising systemic resilience. *Eur. J. Oper. Res.* 268 (3), 852–864.
- Holling, C.S., 1973. Resilience and stability of ecological systems. *Annu. Rev. Ecol. Systemat.* 4, 1–23.
- Ifejika-Speranza, C., Wiesmann, U., Rist, S., 2014. An indicator framework for assessing livelihoods resilience in the context of social-ecological dynamics. *Global Environ. Change* 28 (2014), 109–119.
- Intergovernmental Panel on Climate Change (IPCC), 2012. In: Barros, C.B., Stocker, V., Qin, T.F., Dokken, D., Ebi, D.J., Mastrandrea, K.L., Mach, M.D., Plattner, K.J., Allen, G.-K., S.K Tignor, M., Midgley, P.M. (Eds.), *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change.* Field. Cambridge University Press, Cambridge, UK.
- IPCC, 2007. *Climate Change 2007. Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.*
- IPCC, 2022. *Summary for Policymakers.*
- IPCC, 2014. In: Field, C.B., Barros, D.J., Dokken K.J, Mach, Mastrandrea, M.D., Bilir, T.E., Chatterjee, M., Ebi, K.L., Estrada, Y.O., Genova, R.C., Girma, B., Kissel, E.S., Levy, A. N., MacCracken, S., Mastrandrea, P.S., White, L.L. (Eds.), *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- IRGC, 2005. *White Paper on Risk Governance: toward an Integrative Approach.* The International Risk Governance Council, Geneva.
- Jacobzone, S., Baubion, C., Radisch, J., HochrainerStigler, S., Linnerooth-Bayer, J., Liu, W., Rovenskaya, E., Dieckmann, U., 2020. Strategies to govern systemic risks. In: Hynes, W., Lees, M., Müller, J. (Eds.), *Systemic Thinking for Policy Making: the Potential of Systems Analysis for Addressing Global Policy Challenges in the 21st Century.* Organisation for Economic Co-operation and Development Publishing, Paris.
- Kafle, S.K., 2012. Measuring disaster-resilient communities: a case study of coastal communities in Indonesia. *J. Bus. Continuity Emerg. Plan.* 5 (4), 316–326.
- Keating, A., Hanger-Kopp, S., 2020. Practitioner perspectives of disaster resilience in international development. *Int. J. Disaster Risk Reduc.* 42, 101355.
- Keck, F., 2015. Monitoring animals, preparing humans: an ethnographical study of avian influenza. In: Revet, S., Langumier, J. (Eds.), *Governing Disasters: beyond Risk Culture.* Palgrave Macmillan, London, pp. 59–83.
- Keck, F., 2020. *Avian Reservoirs. Virus Hunters and Birdwatchers in Chinese Sentinel Posts.* Duke University Press, Durham.
- Kelman, I., Gaillard, J.C., Lewis, J., Mercer, J., 2016. Learning from the history of disaster vulnerability and resilience research and practice for climate change. *Nat. Hazards.*
- Kinzig, A.P., Antle, J., Ascher, W., et al., 2000. *Nature and Society: an Imperative for Integrated Environmental Research. A Report Prepared for the National Science Foundation of the United States.*
- Klein, R.J.T., Nicholls, R.J., Thomalla, F., 2003. Resilience to natural hazards: how useful is this concept? *Environ. Hazards* 5, 35–45.
- Klinke, A., Renn, O., 2012. Adaptive and integrative governance on risk and uncertainty. *J. Risk Res.* 15, 2012–2013.
- Kooiman, J., 2003. *Governing as Governance.* Sage.
- Kvale, S., 1996. *An Introduction to Qualitative Research Interviewing (Thousand Oaks, CA).*
- Kvale, S., Brinkmann, S., 2009. *Interviews: Learning the Craft of Qualitative Research Interviewing.* sage.
- Lakoff, A., 2006. *From Disaster to Catastrophe: the Limits of Preparedness. Insights from the Social Sciences.* <http://items.ssrc.org/understanding-katrina/from-disaster-to-catastrophe-the-limits-of-preparedness/>. (Accessed 3 March 2022).
- Lewis, J., 1988. Commentary: Natural Hazard Reduction, 30. *Environment*, pp. 3–4. N° 6.
- Linkov, I., Trump, B.D., 2019. Resilience and governance. In: *The Science and Practice of Resilience. Risk, Systems and Decisions.* Springer, Cham.
- Littles, C.J., Jackson, T.H., Dewitt, M.C., 2018. Linking people to coastal habitats: a meta-analysis of final ecosystem goods and services on the coast. *Ocean Coast Manag.* 165.
- Manyena, S.B., 2014. Disaster resilience: a question of ‘multiple faces’ and ‘multiples paces’? *Int. J. Disaster Risk Reduc.* 8, 1–9.
- Manyena, B., Machingura, F., O’Keefe, P., 2019. Disaster Resilience Integrated Framework for Transformation (DRIFT): a new approach to theorising and operationalising resilience. *World Dev.* 123, 104587.
- Marzi, S., Mysiak, J., Essenfelder, A.H., Amadio, M., Giove, S., Fekete, A., 2019. Constructing a comprehensive disaster resilience index: the case of Italy. *PLoS One* 14 (9), e0221585.
- Masselink, G., Lazarus, E.D., 2019. Defining coastal resilience. *Water* 11 (12), 2587.
- Global Warming of 1.5° C. An IPCC Special Report on the impacts of global warming of 1.5° C above pre-industrial levels and related global greenhouse gas emission pathways. In: Masson-Delmotte, V., Zhai, P., Pörtner, H.-O., Roberts, D., Skea, J., Shukla, P.R., Waterfield, T. (Eds.), 2018. *The Context of Strengthening the Global Response to the Threat of Climate Change.* World Meteorological Organization, Geneva.
- Masten, A.S., Obradovic, J., 2008. Disaster preparation and recovery: Lessons from research on resilience in human development. *Eco. Soc.* 13 (1).
- Matin, N., Forrester, J., Ensor, J., 2018. What is equitable resilience? *World Dev.* 109, 197–205.
- McNamara, C., 1999. *General Guidelines for Conducting Interviews.*
- Middleton, N., O’Keefe, P., 2006. *Politics, History & Problems of Humanitarian Assistance in Sudan, Review of African Political Economy.*
- Mikkelsen, B., 2005. *Methods for Development Work and Research: A New Guide for Practitioners.* SAGE Publications, California: Thousand Oaks, Calif.
- Mojtahedi, M., Oo, B.L., 2017. Critical attributes for proactive engagement of stakeholders in disaster risk management. *Int. J. Disaster Risk Reduc.* 21, 35–43.
- Morelli, A., Taramelli, A., Bozzeda, F., Valentini, E., Colangelo, M.A., Cueto, Y.R., 2021. The disaster resilience assessment of coastal areas: a method for improving the stakeholders’ participation. *Ocean Coast Manag.* 214, 105867.
- Moser, S., Meerow, S., Arnott, J., Jack-Scott, E., 2019. The turbulent world of resilience: interpretations and themes for transdisciplinary dialogue. *Climatic Change* 153 (1), 21–40.
- Norris, F.H., Stevens, S.P., Pfefferbaum, B., Wyche, K.F., Pfefferbaum, R.L., 2008. Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. *Am. J. Community Psychol.* 41 (1–2), 127–150.
- Nurse-Bray, M.J., Vince, J., Scott, M., Haward, M., O’Toole, K., Smith, T., et al., 2014. Science into policy? Discourse, coastal management and knowledge. *Environ. Sci. Pol.* 38, 107–119.
- Ojwang, L., Rosendo, S., Celliers, L., Obura, D., Muihi, A., Kamula, J., Mwangi, M., 2017. Assessment of coastal governance for climate change adaptation in Kenya. *Earth’s Future* 5 (11), 1119–1132.
- Olsson, L., Jerneck, A., Thoren, H., Persson, J., O’Byrne, D., 2015. Why resilience is unappealing to social science: theoretical and empirical investigations of the scientific use of resilience. *Sci. Adv.* 1 (4).
- Orach, K., Schlüter, M., 2016. Uncovering the political dimension of social-ecological systems: contributions from policy process frameworks. *Global Environ. Change* 40, 13–25.
- Parsons, M., Thoms, M.C., 2018. From academic to applied: operationalising resilience in river systems. *Geomorphology* 305, 242–251.

- Parsons, M., Thoms, M.C., Flotemersch, J.E., 2017. Eight river principles for navigating the science-policy interface. *Mar. Freshw. Res.* 68, 401–410.
- Partelow, S., Schlüter, A., Armitage, D., Bavinck, M., Carlisle, K., Gruby, R.L., et al., 2020. Environmental Governance Theories: a Review and Application to Coastal Systems.
- Pelling, M., 2003. *The Vulnerability of Cities*. Earthscan, London.
- Pelling, M., Manuel-Navarrete, D., 2011. (a). From resilience to transformation: the adaptive cycle in two Mexican urban centers. *Ecol. Soc.* 16 (2).
- Pellizzoni, L., 2017. Commenti in "Prisma: economia, società, lavoro" 3, 85–87.
- Pellizzoni, L., 2017a. Resilienza. In: "Territori Vulnerabili" a cura di Mela A., Mugnano S. Olori D. Franco Angeli, Milano.
- Pfefferbaum, B., Pfefferbaum, R.L., Van Horn, R.L., 2015. Community resilience interventions: participatory, assessment-based, action-oriented processes. *Am. Behav. Sci.* 59 (2), 238–253.
- Porter, L., Davoudi, S., 2012. The politics of resilience for planning: a caution-ary note. *Plann. Theor. Pract.* 13, 299–333. <https://doi.org/10.1080/14649357.2012.669996>.
- Portman, M., 2018. Policy options for coastal protection: integrating inland water management with coastal management for greater community resilience. *J. Water Resour. Plann. Manag.* 144.
- Prior, T., Hagmann, J., 2014. Measuring resilience: methodological and political challenges of a trend security concept. *J. Risk Res.* 17 (No3), 281–298.
- Redman, C.L., 2014. Should sustainability and resilience be combined or remain distinct pursuits? *Ecol. Soc.* 19 (2).
- Renn, O., 2008. *Risk Governance: Coping with Uncertainty in a Complex World*. Earthscan, London, UK.
- Ritchie, J., Lewis, J., Nicholls, M., Ormston, R., 2003. *A Guide for Social Science Students and Researchers*. Qualitative Research Practice. sage, London.
- Rodina, L., 2019. Defining "water resilience": debates, concepts, approaches, and gaps. *Wiley Interdisciplinary Reviews: Water* 6 (2), e1334.
- Rodina, L., Baker, L.A., Galvin, M., Goldin, J., Harris, L.M., Manungufala, T., et al., 2017. Water, equity and resilience in Southern Africa: future directions for research and practice. *Curr. Opin. Environ. Sustain.* 26, 143–151.
- Rölfer, L., Celliers, L., Abson, D., 2022. Resilience and coastal governance: knowledge and navigation between stability and transformation. *Ecol. Soc.* 27 (2).
- Rose, A., 2004. Defining and measuring economic resilience to earthquakes. *Disaster Prev. Manag.* 13 (4), 307–314.
- Saunders, B., Sim, J., Kingstone, T., Baker, S., Waterfield, J., Bartlam, B., et al., 2018. Saturation in qualitative research: exploring its conceptualization and operationalization. *Qual. Quantity* 52, 1893–1907.
- Schmidt, L., Gomes, C., Guerreiro, S., O'Riordan, T., 2014. Are we all on the same boat? The challenge of adaptation facing Portuguese coastal communities: risk perception, trust-building and genuine participation. *Land Use Pol.* 38, 355–365.
- Silverman, D., Marvasti, A., 2008. *Doing Qualitative Research: A Comprehensive Guide*. Sage.
- Simeoni, U., Corbau, C., 2009. A review of the Delta Po evolution (Italy) related to climatic changes and human impacts. *Geomorphology* 107 (1–2), 64–71.
- Spangenberg, J.H., Görg, C., Settele, J., 2015. Stakeholder involvement in ESS research and governance: between conceptual ambition and practical experiences—risks, challenges and tested tools. *Ecosyst. Serv.* 16, 201–211.
- Taramelli, A., Di Matteo, L., Ciavola, P., Guadagnano, F., Tolomei, C., 2015. Temporal evolution of patterns and processes related to subsidence of the coastal area surrounding the Bevano River mouth (Northern Adriatic)—Italy. *Ocean Coast Manag.* 108, 74–88.
- Taramelli, A., Manzo, C., Valentini, E., Cornacchia, L., 2018. Coastal subsidence: causes, mapping, and monitoring. In: Singh, Ramesh, Bartlett, Darius (Eds.), *Natural Hazards: Earthquakes, Volcanoes, and Landslides*. CRC Press, pp. 253–290.
- Taramelli, A., Valentini, E., Righini, M., Filippini, F., Geraldini, S., Nguyen Xuan, A., 2020. Assessing Po river deltaic vulnerability using earth observation and a bayesian belief network model. *Water* 12, 2830.
- Tingsanchali, T., 2012. Urban flood disaster management. *Procedia Eng.* 32, 25–37.
- Tobin, G.A., Witheford, L.M., 2002. Community Resilience and Volcano Hazard: the Eruption of Tungurahua and Evacuation of the Faldas in Ecuador. *Disasters*, pp. 28–48.
- Torresan, S., Gallina, V., Gualdi, S., Bellafiore, D., Umgiesser, G., Carniel, S., Scavo, M., Benetazzo, A., Giubilato, E., Critto, A., 2019. Assessment of climate change impacts in the north Adriatic coastal area. Part I: a multi-model chain for the definition of climate change hazard scenarios. *Water* 11, 1157.
- Townend, I.H., French, J.R., Nicholls, R.J., Brown, S., Carpenter, S., Haigh, I.D., Tompkins, E.L., 2021. Operationalising coastal resilience to flood and erosion hazard: A demonstration for England. *Science of the Total Environment* 783, 146880.
- Trigila, A., Iadanza, C., Lastoria, B., Bussetini, M., Barbano, A., 2021. Dissesto idrogeologico in Italia: pericolosità e indicatori di rischio - Edizione 2021. ISPRA. Rapporti 356/2021.
- UNISDR, 2015. *Sendai Framework for Disaster Risk Reduction 2015-2030*. UNISDR, Geneva.
- Vitale, C., Meijerink, S., 2021. Flood risk policies in Italy: a longitudinal institutional analysis of continuity and change. *Int. J. Water Resour. Dev.* 1–25.
- Walker, B.H., Holling, C.S., Carpenter, S.R., Kinzig, A.P., 2004. Resilience, adaptability and transformability in social-ecological systems. *Ecol. Soc.* 9 (2).
- Wardekker, J.A., de Jong, A., Knopp, J.M., van der Sluijs, J.P., 2010. Operationalizing a resilience approach to adapting a delta to uncertain climate changes. *Technol. Forecast. Soc. Change* 77, 987–998.
- Weichselgartner, J., Kelman, I., 2015. Geographies of resilience: challenges and opportunities of a descriptive concept. *Prog. Hum. Geogr.* 39 (3), 249–267.
- Wilson, S., Pearson, L.J., Kashima, Y., et al., 2013. Separating adaptive maintenance (resilience) and transformative capacity of social-ecological systems. *Ecol. Soc.* 18 (1) <https://doi.org/10.5751/ES-05100-180122> art. 22.
- Zhou, H., Wang, J., Wan, J., Jia, H., 2010. Resilience to natural hazards: a geographic perspective. *Nat. Hazards* 53, 21–41.
- Ziervogel, G., Pelling, M., Cartwright, A., Chu, E., Deshpande, T., Harris, L., et al., 2017. Inserting rights and justice into urban resilience: a focus on everyday risk. *Environ. Urbanization* 29 (1), 123–138.
- Zolli, A., Healy, A.M., 2013. *Resilience: Why Things Bounce Back*. Simon & Schuster Paperbacks, New York.