FACING CONTEMPORANEOUS CRISES: A CULTURAL, IDENTITY AND TECHNICAL ISSUE

MARICHELA SEPE
ISMed, CNR, DICEA Sapienza Università di Roma, Italy

ABSTRACT

The increasing frequency of overlapping risks – such as seismic events, depopulation, pollution and socio-cultural decline – calls for new, integrated approaches to urban resilience and adaptation. This study introduces and applies the concepts of multi-resilience and multi-adaptation, defined respectively as the capacity to respond to simultaneous risks through place-sensitive, inclusive strategies and the ability to reach a renewed equilibrium under complex, unpredictable conditions. Developed within the framework of the PRIN 2020 SUMMA project (#20209F3A37), the study proposes a structured, ten-step methodology for analyzing and redesigning public spaces in multi-risk contexts. The process includes the identification of coexisting risks, contributing factors, user perceptions and local assets, leading to the construction of integrated mosaic-maps. These tools synthesize spatial, social and cultural data to guide the formulation of adaptive interventions. The method is tested in two historic towns in the Lazio region of central Italy – Cittaducale and Leonessa – both affected by the 2016 earthquake but characterized by different levels of physical damage and socio-economic fragility. Through fieldwork, qualitative surveys, spatial analysis and community engagement, the study identifies specific vulnerabilities (e.g., seismic risk, depopulation, loss of identity) and context-based opportunities for sustainable regeneration. The proposed interventions include flexible reuse of public spaces, thematic cultural routes and integration of digital tools for risk communication and heritage valorization. A key outcome of the methodology is the multiadaptation place index (MPI), a composite indicator that evaluates a territory's capacity to absorb, adapt and transform under multiple risk conditions. The MPI is calculated by subtracting a weighted score of risks from the sum of identified adaptive assets – such as underused spaces, cultural value and infrastructural flexibility. The resulting index offers a concrete tool for comparing and prioritizing interventions across territories, highlighting areas with the highest potential for sustainable transformation.

Keywords: multirisk, multiresilience, multiadaptation, multiadaptation place index, sustainability.

1 INTRODUCTION

The growing complexity of contemporary territories is increasingly shaped by the overlapping and co-occurring nature of multiple crises – ranging from environmental hazards such as earthquakes, pollution, and floods, to social fragilities, cultural decay, pandemics, and other systemic disruptions [1], [2]. These compound and interrelated risks challenge the efficacy of conventional planning and response strategies, which often rely on linear models and isolated interventions [3]. Within this evolving context, the concept of resilience has gained widespread attention across disciplines including ecology, economics, political science, and urban studies [4]. However, its usage often simplifies the nature of crises, treating them as homogeneous events that can be addressed through generic strategies. This tendency fails to distinguish between sudden shocks (like earthquakes) and ongoing stressors (such as depopulation or infrastructural decline), resulting in ambiguity and inconsistency in both its theoretical framing and practical application – particularly in complex urban environments [5], [6]. Cities and towns are not neutral or uniform spaces. They are highly differentiated systems, shaped by layers of historical, cultural, and socio-economic forces [7]. Spatial inequalities, resource disparities, and uneven access to services further complicate any assessment of resilience. In such contexts, traditional notions of resilience that aim to 'bounce back' to a previous state are insufficient [8]. Similarly, the concept of

WIT Transactions on The Built Environment, Vol 217, © 2025 WIT Press
www.witpress.com, ISSN 1743-3509 (on-line)
doi:10.2495/ERES250101

adaptivity is not always interpreted consistently, applied alternately to planning processes, governance models, and the physical adaptation of buildings and public spaces [9], [10]. These fragmented interpretations can hinder the development of coherent strategies for territories affected by multiple, interconnected risks.

To address these challenges, this research introduces two original complementary definitions: multi-resilience and multi-adaptation. Multi-resilience refers to the capacity of a system to respond to the simultaneous presence of diverse risk types, recognizing the need for context-sensitive approaches that account for the specific geography, culture, and socio-economic structure of each place [20]. Crucially, it also calls for the involvement of multiple stakeholders, including local communities, public institutions, and technical experts [11]–[15]. Multi-adaptation, in turn, describes the system's ability to evolve toward a new and inclusive equilibrium in response to complex, unpredictable, and layered risk scenarios. Rather than simply recovering from disaster, multi-adaptation implies a creative and proactive transformation of space, governance, and community engagement [16]–[18].

This study – developed within the framework of the PRIN 2020 SUMMA project (#20209F3A37) – proposes a methodological approach for analyzing and redesigning public spaces under conditions of multi-risk, with particular attention to areas exposed to seismic events. The methodology is structured around the concept of holistic resilience, aiming to integrate adaptive urban design with participatory risk management and cultural heritage preservation. Through the case studies of Cittaducale and Leonessa, two historic towns in the Lazio region of central Italy affected by the 2016 earthquake, the research applies this methodology in a concrete setting. By calculating the multiadaptation place index (MPI), the study evaluates each town's capacity for adaptive and resilient transformation, balancing physical risks with socio-cultural opportunities [19]–[24].The findings lead to the formulation of practical guidelines for sustainable, multi-adaptive reconstruction. These guidelines emphasize the dual importance of enhancing local cultural assets and fostering inclusive risk governance. By embedding multi-resilience and multi-adaptation into spatial planning and design processes, the study offers a forward-looking model for territorial regeneration that is both contextually grounded and future-oriented. The paper is organized as follows: Section 2 illustrates the methodology; Section 3 the results of the case studies; Section 4 the observations, finally, Section 5 draws the conclusions with the guidelines [20]–[25].

2 MULTIADAPTATION METHODOLOGY

The methodology designed to assess environments exposed to multiple risks follows a systematic process made up of ten well-defined stages: six focused on assessment and three on planning. The main goal of this methodology (Table 1) is to detect existing or potential risks – whether isolated or overlapping – that may affect open public spaces. It also seeks to identify the root causes of these risks, understand how they are perceived by users, and formulate interventions aimed at both adapting these spaces and enhancing their quality. The methodology produces two detailed mosaic maps and the MPI. One of the mosaic compiles all collected information that includes risks, contributing factors, and user perceptions. The second mosaic presents suggested actions for adaptation and improvement. The MPI measures the ability of a place to adapt to multiple risks while also enhancing its valuable features.

The first step centres on evaluating the area in question to pinpoint existing or anticipated urban risks (Table 2). This is done using a structured observation form that helps assess and rate the risks as minor, moderate, or severe. The types of risks that can be identified through

Table 1: Multiadaptation method scheme.

Phase	Objective	Actions	Product
1	Identification of single 'urban' risks	Observation of the places	Mosaic of the single risks
2	Analysis of factors contributing to the risks	Identification of the factors	Mosaic of concurrent risk factors
3	Analysis of the effects due to the coexistence of risks	Observation of the effects	Mosaic of effects
4	Risk perception questionnaires	Questions asked onsite to users of places and social network analysis	Mosaic of risk perception by place users
5	Analysis of plans/ projects/programmes/ policies for adaptation	Identification of projects and plans that provide for adaptation to risks	Mosaic of plans/ projects/programmes/ actions
6	Analysis of potentialities and qualities	Identification of factors which contribute or can contribute to the quality of the place	Mosaic of the quality elements from the urban point of view
7	Multirisks analysis	Identification of all present and probable risks, related factors, user perceptions, quality of places	Multirisk mosaic
8	Flexible area identification	Identification of areas with potential flexible use	Mosaic of flexible uses
9	Multiadaptation project interventions	Identification of project interventions of adapatation/enhancement	Multiadaptation mosaic
10	Measurement of degree of multiadaptation	Identification of areas with the greatest potential for adaptive change and growth.	MPI

Table 2: Step 1 survey, risk identification.

	Risk	Place where is observed	Quantity
tipology			Low, medium, high
anticipate			
current			

this observational approach include physical decay, environmental issues, social and cultural threats, human-induced and seismic hazards, public health concerns, low quality of life, insecurity, and the potential loss of local identity. The aim is to build a comprehensive risk profile of the area by categorizing and documenting these issues systematically.

Once the risks have been identified, the second step involves analyzing the elements and conditions that either currently influence or have the potential to influence those risks (Table 3). This phase uses qualitative research based on detailed observation to uncover the underlying causes of each risk. For example, poor waste disposal may be a major contributor to environmental degradation, while social disconnection could increase the perception of insecurity. Because of its qualitative nature, this step captures the complex interrelations among the various urban dynamics.

Table 3: Step 2 survey, factors identification.

	Risk	**Main elements influencing the risk**	**Related (urban, social, etc.) conditions**
tipology			
real			
potential			

The third stage examines the consequences of having multiple risks coexisting in the same location (Table 4). This involves setting up a database that records each risk type, their interactions, and the severity of their combined impact – categorized as low, moderate, or high. As an example, a location with both seismic risk and a lack of cultural identity may no longer function well as a space for community gathering due to increased feelings of unsafety and a weakened sense of place. This stage offers a quantitative understanding of how compounded risks affect urban environments and lays the groundwork for targeted solutions.

Table 4: Step 2 survey, effect identification.

	Risk	**Effects of on the risk**	**Effects of combination of risks**
tipology			
tipology			
tipology			

Gaining insights into how people perceive these risks is essential, and this is done through a risk perception survey (Step 4). The aim of the questionnaire is to understand how individuals experience and interpret the identified risks, whether they view them as persistent or temporary, and how they believe they could contribute to reducing these risks. The survey covers general impressions of the location, detailed perceptions of specific risks, their perceived permanence, and ideas for citizen involvement, along with feedback on the overall quality of the space.

In the fifth step, the focus shifts to identifying current plans, strategies, and policy measures that relate to the area. This involves a full review of all ongoing efforts – across various sectors and scales – that aim to reduce or prevent risks. The outcome is a mosaic that illustrates the current measures, informing the direction of future actions.

Following this, the methodology focuses on identifying the valuable features of the location, such as heritage buildings, open public areas, green spaces, and historic urban layouts. This step merges the existence of these elements with their current functions, assessing both their worth and adaptability. For instance, a historic plaza may be overlooked due to neglect but has potential for renewal through specific improvements. The outcome is a mosaic that visually represents these quality features and their uses, offering a base for suggesting future enhancements.

The seventh phase consists of developing a mosaic that brings together all earlier findings: identified risks, influencing factors, results from user perception surveys, and quality elements. This all-encompassing mosaic acts as a visual summary of the multi-risk environment, tying together the different layers of analysis into a single, unified view. It displays the types of risks affecting public spaces and the variables that contribute to them, offering a detailed overview of the area's vulnerability and forming an essential planning tool.

In step eight, the analysis turns to evaluating the area's adaptability by studying the multi-risk mosaic. This step helps determine which parts of the space can be flexibly reimagined for resilience initiatives. It also highlights where interventions are most urgently required, guiding actions to improve the usability and safety of public areas. For example, a little-used green zone might be flagged as ideal for public activities and community-based resilience efforts. The outcomes of this analysis lead to the formulation of the MPI.

The ninth step is focused on designing multiadaptation place interventions in the areas pinpointed earlier. These proposals aim both to manage present and future risks and to improve public space quality. The result is a mosaic that illustrates concrete, flexible measures for urban transformation. Each proposed action is customized to tackle specific challenges and build upon the quality elements identified, ensuring an integrated and strategic approach to building urban resilience.

The final step (step 10) involves computing the MPI. This index evaluates how well different parts of the urban area can respond to diverse and simultaneous risks, including unforeseen developments.

The MPI is calculated comparing the collected elements from the step-eight mosaic-map. This mosaic highlights which parts of the area hold the greatest potential for adaptive change and growth.

Several variables are considered in this mosaic: existing and possible risks, both perceived and actual; underutilized or expansive public areas; wide streets with potential for pedestrian or cycling infrastructure; cultural assets (tangible and intangible) revealed through fieldwork or surveys; and public spaces outside the core study area but potentially linked to it.

Each factor is given a score, ranging from 1 (lowest weight) to 5 (highest). The MPI is then calculated by subtracting the total weighted risks from the total weighted flexibility assets. The index spans from 1 to 50, with 1 showing the least capacity for adaptation and 50 representing the highest potential for dynamic transformation.

As an illustration, the combined impact of environmental, depopulation, and social isolation risks may be given a total score of 15. Conversely, an area that includes numerous spacious or underutilized public spaces, broad streets ideal for walking and cycling routes, and close access to cultural landmarks might receive a score of 50. In this scenario, the MPI is calculated by subtracting the risk score (15) from the flexibility score (50), resulting in an MPI of 35. This index delivers a concrete metric for assessing a location's capacity for dynamic adaptation and enhancement, factoring in both existing threats and latent possibilities.

The MPI is versatile and can be applied across various urban settings to gauge and improve their resilience and adaptability. It enables city planners and decision-makers to pinpoint areas needing attention, prioritize funding, and create initiatives that address both present conditions and future challenges [19], [20].

3 TWO CASE STUDIES

The case studies of Cittaducale and Leonessa concern two historic centres located in the province of Rieti, both affected by the 2016 earthquake.

Cittaducale and Leonessa (Figs 1 and 2) are both situated in an inland area of central Italy, characterized by a mountainous landscape and a medieval urban layout. However, the extent and nature of the damage caused by the 2016 seismic sequence varied significantly. Cittaducale experienced limited structural damage, with no compromise to its overall urban fabric, yet the town remains exposed to a range of interconnected risks: in addition to the seismic threat, there are ongoing issues related to depopulation, infrastructural isolation, and a loss of identity. Conversely, Leonessa suffered more visible damage, particularly to its religious and architectural heritage, while maintaining its compact urban structure. The earthquake, however, accelerated pre-existing abandonment processes, making it urgent to reflect on the potential of cultural heritage as a tool for economic and social revitalization.

Figure 1: Cittaducale, Rieti, Piazza del Popolo. (*Source: Photo by the author.)*

Figure 2: Leonessa, Rieti, detail of Piazza Garibaldi. (*Source: Photo by the author.*)

In the analysis of Cittaducale, carried out through the ten-step method, four main risks were identified: seismic, depopulation, isolation, and identity loss. Although the 2016 earthquake did not cause large-scale destruction, it heightened awareness of seismic risk, which the group of fifty respondents largely perceived as temporary. Of greater concern are the risks of depopulation and isolation, which are closely linked: lack of job opportunities, low appeal for younger generations, and poor connectivity to nearby areas all contribute to the gradual emptying of the historic centre. The identity risk, though less immediately perceived, remains present, particularly in connection with the misuse or abandonment of public spaces and historic buildings with symbolic value. The questionnaire responses reveal a divided population: some see citizens as having an active role in risk mitigation, while others believe this responsibility lies solely with public authorities. However, there is unanimous recognition of the area's historical, cultural, and scenic quality – churches, squares, and surrounding valleys are seen as key features of local identity.

Leonessa, on the other hand, focused its perceptual analysis primarily on the experiential dimension of place, involving forty participants – mainly Italian visitors and locals aged between 30 and 60. Attention was given to the quality of the main urban axes and squares, as well as the richness of religious heritage. The feedback paints a picture of a 'pleasant' place, yet one marked by widespread scaffolding and ongoing restoration work, serving as a constant reminder of the vulnerability of the built environment. In addition to visual perception, acoustic perception was also strong, tied to construction noise and the surrounding quiet. Sensory elements also emerged through references to local products such as honey and sweets, and to the tactile experience of the historic cobblestone paving. Overall, the city is perceived as a peaceful centre, but one that is underappreciated and in need of greater attention – both in the use of public spaces and in its integration with the surrounding territory.

The traditional analysis of the two town centres reveals further differences. Cittaducale features a regular urban layout, structured around the intersection of two orthogonal axes that form Piazza del Popolo.

Its historic centre is compact, rich in significant monuments and open spaces, including secondary squares and the Terme di Vespasiano, which today are largely underused. The town's configuration allows for easy navigation and slow-paced enjoyment, making it well-suited for pedestrian tourism. Leonessa, by contrast, is organized along three main streets – Corso San Giovanni, Via Mastrozzi, and Via San Francesco – which connect Porta Spoletina to Piazza VII Aprile. Its medieval structure is more complex and radial, yet it maintains internal coherence. The presence of churches, historic gates, and the scenic backdrop of Mount Terminillo gives the town a strong sense of visual drama and identity. The design proposals vary according to the specific risks and local resources. In Cittaducale, the goal is to mitigate risks through the adaptive reuse of urban spaces and thematic routes. Squares, often unused or stripped of their social function, are reimagined as flexible spaces that can host cultural events, markets, and gatherings, while also serving as emergency meeting points in the event of an earthquake. Four routes have been proposed: architectural, landscape/naturalistic, religious, and artistic-craft. Each one highlights a different aspect of the area, with the shared goal of reactivating both physical and symbolic connections between places, buildings, and communities. Digital tools such as QR codes, apps, and information portals are included to ensure accessibility to maps and information, even during emergencies.

Leonessa, on the other hand, adopts an experiential approach to heritage enhancement. Here too, three thematic routes have been identified – religious, artisanal-artistic, and sports/naturalistic – which extend across the town and its surroundings, forming a network

that integrates both tangible and intangible heritage. The religious path connects ideally and physically with the routes of Saint Francis, strengthening ties with Rieti and other places of Franciscan spirituality. The arts and crafts route aims to promote local artisan workshops, engaging visitors and families through educational experiences and tastings. The naturalistic and sporting route unfolds across Mount Terminillo, including hiking activities and targeted landscape improvements. In this case, the focus is primarily on reactivating symbolic sites and creating an integrated tourism offer that links Leonessa to existing regional networks.

In conclusion, both case studies show that territorial resilience goes beyond post-earthquake reconstruction and requires a broader multiadaptation reflection on transformation processes, local identities, and the untapped potential of places. Cittaducale, facing multiple yet manageable risks, aims to respond through flexible urban planning and a network of routes that enhance its existing heritage. Leonessa, instead, works on the sensory and experiential dimension, seeking to renew its image through a system of itineraries that combine spirituality, tradition, and nature.

The study of Cittaducale and Leonessa presents an opportunity to explore how two medieval towns in central Italy, both impacted by the 2016 earthquake, could respond to vulnerability through strategies of multiadaptive reuse, spatial revitalization, and community engagement. To measure their capacity for adaptation and sustainable transformation, the MPI – Step 10 – offers a structured and comparative metric.

Cittaducale exhibits a compact and coherent urban layout, defined by a regular grid converging at Piazza del Popolo. Its monumental heritage, scenic surroundings, and walkable structure provide a strong foundation for flexible and inclusive spatial development. Despite limited structural damage during the 2016 earthquake, the town remains affected by layered risks: a residual seismic threat, demographic decline, infrastructural isolation, and erosion of cultural identity. These were each assigned reduced risk scores based on recent mitigation efforts and community responses: seismic risk (1), depopulation (5), isolation (2), and identity loss (2), for a total risk score of 10.

On the adaptability side, Cittaducale's potential is noteworthy. It benefits from underused yet highly valuable public spaces like the Terme di Vespasiano, the secondary squares and the other monuments (40) and a pedestrian-friendly layout (10). Community participation and territorial landscape assets further elevate the town's flexibility score to 50. Subtracting the risks, Cittaducale achieves an MPI of 40, indicating a solid and realistic capacity for dynamic adaptation and sustainable urban enhancement.

Leonessa, by contrast, experienced more extensive earthquake-related damage, particularly to its religious and architectural structures. However, it retained a compact urban morphology with strong symbolic resonance, underscored by a visually striking alignment of sacred landmarks and natural views. While the town faces persistent risks – abandonment (6), seismic vulnerability (1) and exposure of the built environment (1) – these have been somewhat mitigated through ongoing restoration and increased cultural engagement, resulting in a total risk score of 8.

Leonessa's adaptive strength lies in its multi-sensory, experiential development strategy. A rich cultural–religious landscape (20), complemented by scenic coherence (10), artisanal promotion (10), and a direct link to Mount Terminillo for eco-tourism and sports (10), form the core of a vibrant and layered place, for a total town's flexibility score of 50. The resulting MPI of 42 places Leonessa in a highly favourable position to reactivate its economy and reinforce its cultural relevance. Both towns demonstrate how a blend of physical restoration, community inclusion, and cultural innovation can convert seismic vulnerability into long-term resilience. Cittaducale's moderate MPI reflects its current transition toward a more flexible urban model, while Leonessa's slightly higher MPI signals the potential of sensory-

driven regeneration strategies. The MPI proves an effective indicator in identifying and promoting sustainable pathways tailored to each town's unique strengths and challenges – turning risk into opportunity through place-based planning.

4 OBSERVATIONS

The application of the multiadaptation method to the cases of Cittaducale and Leonessa provides not only a framework for understanding urban resilience under multi-risk conditions but also a critical lens through which the interplay between context, community, and space can be assessed. One of the strengths of this method lies in its holistic structure, which goes beyond identifying risks in isolation and instead emphasizes their co-presence, interrelations, and compounded effects. The ten-step process ensures that analysis is not only evidence-based but also context-specific, incorporating both objective data (e.g., physical conditions, built environment) and subjective input (e.g., user perception, community priorities). This dual-layered analysis strengthens the legitimacy of the findings and supports informed decision-making.

By layering various dimensions – risks, perceptions, assets, policies – the mosaic function as dynamic diagrams capable of guiding spatial strategies and urban interventions. However, this also require careful interpretation to avoid over-simplification. Not all variables carry the same weight in different localities, and this calls for flexibility in both data collection and representation.

In terms of the case studies, Cittaducale and Leonessa demonstrate the flexibility and adaptability of the methodology to different urban contexts. Cittaducale, with its strong spatial structure and underutilized assets, exemplifies how latent potential can be unlocked through adaptive planning and heritage-based regeneration. The city's challenges – particularly depopulation and infrastructural isolation – are not uncommon in rural and mountain communities across Europe. What stands out, however, is the proposed integration of digital tools and thematic routes to reconnect spaces and engage the population. These design choices emphasize a forward-looking approach grounded in everyday usability and cultural identity.

Leonessa, by contrast, emerges as a case where emotional and sensory engagement drive the regeneration agenda. Its attention to experiential tourism, artisanal knowledge, and landscape integration positions the town within broader narratives of slow tourism, wellness, and cultural sustainability**.** The MPI value of 42 reflects a favourable balance between adaptive capacity and manageable risk. Nevertheless, long-term resilience will depend not only on physical upgrades but also on sustaining the community's involvement and economic viability.

The MPI itself is a valuable contribution to the field of resilience assessment. Unlike static indicators, the MPI measures both risk exposure and the degree of spatial flexibility in a single, interpretable value. However, the success of the MPI relies on accurate weight attribution to both risks and assets. Future applications might benefit from integrating real-time data (e.g., mobility patterns, economic flows) and from testing the MPI across a wider range of urban typologies [19].

Finally, a key takeaway from this research is that resilience is deeply territorial. Both Cittaducale and Leonessa show that post-seismic reconstruction is not merely about rebuilding structures but about reweaving socio-spatial connections**,** reviving identity, and creating adaptable systems that embrace complexity. The methodology affirms that resilience must be multi-scalar, participatory, and culturally rooted**,** and the MPI offers a powerful means to support this shift in urban and regional planning.

5 CONCLUSION: GUIDELINES FOR MULTIADAPTING PLACES

The analysis of diverse case studies – including Cittaducale and Leonessa (Lazio), Siena, Naples, Madrid, Paris, Rotterdam, Copenhagen, and New York – has led to the formulation of a comprehensive set of principles aimed at guiding urban and territorial resilience in multi-risk environments, with particular attention to the seismic risk. These places were chosen for their exposure to various hazards: seismic activity and demographic decline (Cittaducale, Leonessa); mass tourism and globalization (Siena, Naples, Madrid); flooding, identity erosion and tourism-related saturation (Rotterdam, Paris, Copenhagen and New York).

These principles are rooted in the idea that risk should not only be seen as a threat, but as an opportunity to rethink, improve, and regenerate places. In this framework, resilience becomes a critical component of sustainable transformation, fostering inclusivity, innovation, and adaptive capacity. As risks grow more interconnected – environmentally, socially, and economically – the proposed guidelines are designed to be flexible and updatable, adaptable to new types of risk and emerging urban challenges.

1. Proactive risk mapping. Risk assessment must begin with a preventive and proactive approach, identifying not only present dangers, e.g. the seismic risk, but also latent or long-term vulnerabilities, such as climate stress, socio-economic fragility, or cultural displacement. Both tangible (infrastructure, environment) and intangible (identity, governance) factors must be considered in a comprehensive framework.
2. Multi-hazard and compound risk recognition. Risks rarely occur in isolation. Planning must acknowledge the coexistence and interplay of different hazards, such as seismic risk combined with depopulation. Strategies must adopt a multi-risk logic capable of managing simultaneous disruptions.
3. Integration of proximity networks. Adaptation should not be confined to the immediate area of impact but must consider surrounding systems – including nearby towns, rural areas, and infrastructural nodes. This proximity-based logic creates a territorial safety net, distributing resilience functions, supporting services, and enabling spatial continuity in emergency or post-crisis phases.
4. Inclusion of vulnerable populations. Adaptive strategies must prioritize the inclusion of fragile and at-risk groups – elderly residents, migrants, people with disabilities, or socioeconomically marginalized communities – ensuring their voices are represented in both risk evaluation and project design.
5. Perception and participation. Understanding how residents and users perceive risks is essential. This can be achieved through surveys, interviews, and participatory processes that illuminate local knowledge, fears, expectations, and values – offering critical insight into the cultural and emotional dimensions of adaptation.
6. Place-based asset mapping. Public spaces, cultural heritage, and ecological resources – whether iconic or everyday – must be reinterpreted as active agents of resilience. Their adaptive reuse can reinforce identity, improve liveability, and serve as platforms for emergency response and community cohesion.
7. Context-sensitive and scalable design. Each territory has unique characteristics. Adaptive strategies must be site-specific, responding to the spatial, historical, and social identity of different urban fabrics (e.g., historic centres vs. peripheries). At the same time, design must be scalable, operating across levels from buildings to entire city systems.
8. Flexibility across sectors and scales. A resilient city is an interconnected system. Interventions should bridge urban design, mobility, environment, economy, and

governance, ensuring coordination from the micro (e.g., buildings, street furniture) to the macro scale (e.g., infrastructure, zoning, networks).

9. Continuous monitoring and adaptive capacity. Resilience is not static. Ongoing monitoring and scenario planning are essential to anticipate shifts and respond dynamically. This requires building institutional and community capacities for learning, feedback, and real-time adjustment.
10. Risk communication and engagement. Clear and inclusive communication is fundamental. Information on risks, actions, and policies must be accessible to all age groups and abilities, using visual storytelling, educational tools, and interactive formats to empower citizens and reduce uncertainty.
11. Digital technologies for coordination and transparency. New technologies – apps, smart sensors, web portals, and augmented reality – should be leveraged to enhance transparency, participation, and coordination before, during, and after risk events. These tools must support both planning and emergency response.
12. Measurable multiadaptation indicators. To guide and evaluate adaptive transformation, resilience must be quantified through contextual indicators. Instruments such as the MPI offer an integrated metric, balancing risk exposure with adaptive assets, and allowing for continuous monitoring, benchmarking, and policy refinement.

Together, these twelve principles form a dynamic and operational framework for cities and regions confronting multi-risk scenarios, with particular attention to the seismic risk and related ones. They reinforce the idea that resilience is not merely about survival or repair, but about active transformation and regeneration, rooted in place identity and long-term sustainability.

ACKNOWLEDGEMENT

Financial support from the Italian Ministry of University and Research (MUR) in the framework of the Project PRIN2020 #20209F3A37 is gratefully acknowledged.

REFERENCES

[1] Cutter, S.L., Boruff, B.J. & Shirley, W.L., Social vulnerability to environmental hazards. *Social Science Quarterly*, **84**(2), pp. 242–261, 2003.
[2] Davoudi, S. et al., Resilience: A bridging concept or a dead end? *Planning Theory and Practice*, **13**(2), pp. 299–333, 2012.
[3] Meerow, S., Newell, J.P. & Stults, M., Defining urban resilience: A review. *Landscape and Urban Planning*, **147**, pp. 38–49, 2016.
[4] Vale, L.J. & Campanella, T.J., *The Resilient City: How Modern Cities Recover from Disaster*, Oxford University Press: Oxford, 2005.
[5] Soja, E.W., *Seeking Spatial Justice*, University of Minnesota Press: Minneapolis, 2010.
[6] Alexander, D., *Principles of Emergency Planning and Management*, Oxford University Press: Oxford, 2002.
[7] Folke, C. et al., Resilience thinking: Integrating resilience, adaptability and transformability. *Ecology and Society*, **15**(4), 20, 2010.
[8] Gunderson, L.H. & Holling, C.S. (eds), *Panarchy: Understanding Transformations in Human and Natural Systems*, Island Press: Washington, DC, 2002.
[9] Leichenko, R., Climate change and urban resilience. *Current Opinion in Environmental Sustainability*, **3**(3), pp. 164–168, 2011.

[10] Adger, W.N., Arnell, N.W. & Tompkins, E.L., Successful adaptation to climate change across scales. *Global Environmental Change*, **15**(2), pp. 77–86, 2005.
[11] Agrawal, A., Dismantling the divide between indigenous and scientific knowledge. *Development and Change*, **26**(3), pp. 413–439, 1995.
[12] Arnstein, S.R., A ladder of citizen participation. *Journal of the American Planning Association*, **35**(4), pp. 216–224, 1969.
[13] Berkes, F., Evolution of co-management: Role of knowledge generation, bridging organizations and social learning. *Journal of Environmental Management*, **90**(5), pp. 1692–1702, 2009.
[14] Pickett, S.T.A., Cadenasso, M.L. & Grove, J.M., Resilient cities: Meaning, models, and metaphor for integrating the ecological, socio-economic, and planning realms. *Landscape and Urban Planning*, **69**(4), pp. 369–384, 2004.
[15] Campanella, T.J., Urban resilience and the recovery of New Orleans. *Journal of the American Planning Association*, **72**(2), pp. 141–146, 2006.
[16] Godschalk, D.R., Urban hazard mitigation: Creating resilient cities. *Natural Hazards Review*, **4**(3), pp. 136–143, 2003.
[17] Innes, J.E. & Booher, D.E., Reframing public participation: Strategies for the 21st century. *Planning Theory and Practice*, **5**(4), pp. 419–436, 2004.
[18] Pelling, M., *Adaptation to Climate Change: From Resilience to Transformation*, Routledge: London, 2011.
[19] Sepe, M., Adaptive places: Achieving resilience by facing risks. *WIT Transactions on Ecology and the Environment*, vol. 258, WIT Press: Southampton and Boston, pp. 261–272, 2022. https://doi.org/10.2495/SDP220241.
[20] Sepe, M., Measuring uncertainty: facing place mutations sustainably. *WIT Transactions on Ecology and the Environment*, vol. 262, WIT Press: Southampton and Boston, pp. 139–150, 2024. https://doi.org/10.2495/SDP240131.
[21] Renn, O., *Risk Governance: Coping with Uncertainty in a Complex World*, Earthscan: London, 2008.
[22] Satterthwaite, D., Cities' contribution to global warming: Notes on the allocation of greenhouse gas emissions. *Environment and Urbanization*, **20**(2), pp. 539–549, 2008.
[23] Slovic, P., *The Perception of Risk*, Earthscan Publications: London, 2000.
[24] Tschakert, P. & Dietrich, K.A., Anticipatory learning for climate change adaptation and resilience. *Ecology and Society*, **15**(2), p. 11, 2010.
[25] Walker, B. & Salt, D., *Resilience Thinking: Sustaining Ecosystems and People in a Changing World*, Island Press: Washington, DC, 2006.