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Resilience and Cultural Heritage in Urban Development: From Holistic Guidelines to Practical Approaches

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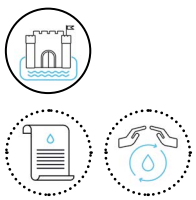
Water plays a dual role in the context of cultural heritage: it can be of great importance, but it can also threaten the existence of built heritage. This article explores the intricate relationship between water and built heritage, focusing on the risks posed by climate change-induced events such as heavy rainfall, which can lead to flooding and surface water run-off. The research project "Resilience and Built Heritage" focused on how built heritage contributes to urban resilience and emphasizes the imperative of integrated risk management, which requires collaboration between heritage professionals and risk managers. The challenges identified include mutual understanding of the disciplines of heritage protection and risk management and a lack of clarity in defining common objectives. Hence, integrated risk management is proposed as a comprehensive concept, encompassing an all-hazards approach and analytical as well as normative steps of risk evaluation and management. Integrated risk management can help develop consistent, holistic, integrative strategies to sustainably protect our built heritage – and thus strengthen its resilience to risk.

Keywords: *built heritage, integrated risk management, urban resilience, heavy rain, climate change*

KEY THEMES



< Fig. 1 Flooding of the Danube River, Stone Bridge, Regensburg, Germany (Source: Stefan Greiving, 2021).

Water as a Threat to Cultural Heritage

Water is, in various ways, part of the cultural heritage of communities. Physical structures as well as institutions, laws, artistic practices and rituals witness human interaction with water and represent its importance for (local) identity as tangible and intangible heritage (Hein et al. 2022). At the same time, water can threaten other forms of built heritage, such as historic ensembles and individual buildings, especially through heavy rainfall which, in turn, can lead to pluvial and fluvial flooding and run-off. Due to climate change, warm air can contain more water, and at the same time, more water evaporates at the sea surface; in addition, the slowing jet stream makes clouds linger above certain areas, so that, overall, the likelihood of heavy rainfall is growing and thus, increasingly threatening cultural heritage (Intergovernmental Panel on Climate Change [IPCC] 2023).

The Need for Integrated Risk Management

Integrated approaches involving heritage professionals and risk managers are therefore needed to protect built heritage effectively. The research project *Resilience and Built Heritage*, funded by the German Federal Ministry for Housing, Urban Development and Building (BMWSB) and the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR), investigated existing approaches and how they can be strengthened in European cities. As a result, two papers were published: a guidance paper (BBSR 2023b), including ten guiding principles on general requirements for improving integrated risk management at a higher level; and a handbook (*Arbeitshilfe*; BBSR 2023a), intended especially for German practitioners as a resource for implementing guidance on the local level. The project was part of one of the eleven actions included in the European Union's Urban Agenda.

Until now, such integrated approaches have been unsatisfactory – for three different reasons. First, a systematic neglect of the respective other side is only slowly being overcome; risk management has only recently begun to include heritage as a protection good, while, in turn, heritage management and monument preservation still largely disregard the need to consider risk management.[1] Awareness usually only arises when a disaster strikes and is quickly forgotten after recovery. Second, there is a lack of mutual understanding and no common knowledge base. Both disciplines speak very different languages, using their own technical terms and concepts (such as "diverse risk assessment methods" among those focused on risk, and concepts of "values" and "protection-worthiness" among those concerned with heritage). And third, the definition of common objectives, both disciplinary and interdisciplinary, often lacks clarity. Questions such as "Which cultural assets and sites are we to consider vulnerable, regarding which particular threat?" or "What is an acceptable level of risk?" may not be easy to answer – but they need to be put on the table first, which is not always the case. The setting of such a normative basis is crucial because it includes fundamental political discussions and decisions, and finally leads to the evaluation of risk and the choice of measures for prevention and recovery (BBSR 2023b).

Integrated risk management for built heritage is a comprehensive concept that aims to strength-

1. On an international level in the World Heritage context, risk is starting to be addressed, for example in the elaboration of management plans (UNESCO 2013).

en the connection between both disciplines. The following three key features characterize its comprehensiveness:

First, the pursuit of the "all-hazards approach" is recommended, which means that all kinds of natural and human-made threats (e.g., flooding, storms, droughts, earthquakes, fire, technical collapses, armed conflict), as well as interactions between those, should be considered. This is related to the fact that civil protection in countries such as Germany is always guided by a multi-hazard approach (Greiving 2011), making it, therefore, a compatible concept.

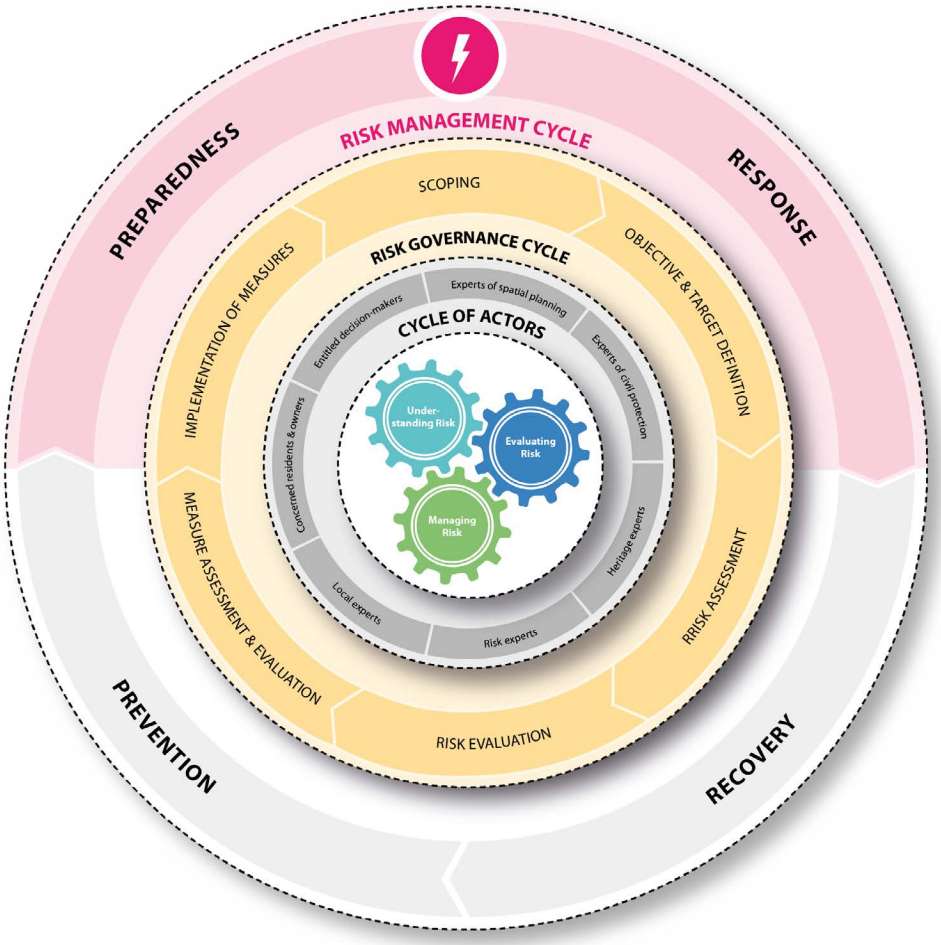
Another feature of integrated risk management for built heritage is that it strives for a systematic approach to cultural heritage. Thus, tangible as well as intangible heritage is addressed, as is the connection between cultural and natural heritage; moreover, it includes state-listed monuments as well as assets and places that are not formally protected but are nonetheless meaningful to local communities (BBSR 2023a; Bierwerth 2014).

Finally, integrated risk management is not limited to the moment of disaster and immediate response but includes all four phases of the risk management cycle: prevention, preparedness, response and recovery. The activities in each stage should refer to and build on each other as much as possible (SHELTER 2019). "Prevention" here refers to the outright avoidance of adverse impacts of hazards and related disasters. "Preparedness" includes the knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to and recover from the impacts of likely, imminent and current hazard events and conditions. "Response," during or immediately after a disaster, means the provision of emergency services and public assistance to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of people affected. And finally, "recovery" is defined by the restoration and, where appropriate, improvement of facilities, livelihood and living conditions of disaster-affected communities, including efforts to reduce future disaster risk.

The Risk Governance Framework as a Scientific Basis for Integrated Risk Management

These stages, in turn, are part of the so-called risk governance framework (fig. 2). Beside the four phases of the risk management cycle, this framework depicts various relevant actors in the process, such as experts in the different disciplines and entitled decision-makers. More importantly, a second cycle is included in the framework: the risk governance cycle (International Risk Governance Center [IRGC] 2017) offers another way to capture the overall nature of risk management. Instead of focusing on the different phases, this approach looks behind the scenes, with steps divided into scientific analysis and expert activity on the one hand and normative and political decisions on the other. These risk governance cycle steps take place within the above-mentioned stages of risk management and thus form the basis for each of the risk management cycle steps. The key message here is that risk management is built on both interdisciplinary expertise and political and legal decisions. These factual (analytical) and normative steps are closely interlinked and require careful attention, as the respective interdisciplinary and transdisciplinary dialogues need consistent risk governance.

Finally, three gears are at the heart of this framework, each representing one core topic for integrated risk management: *understanding risk,*

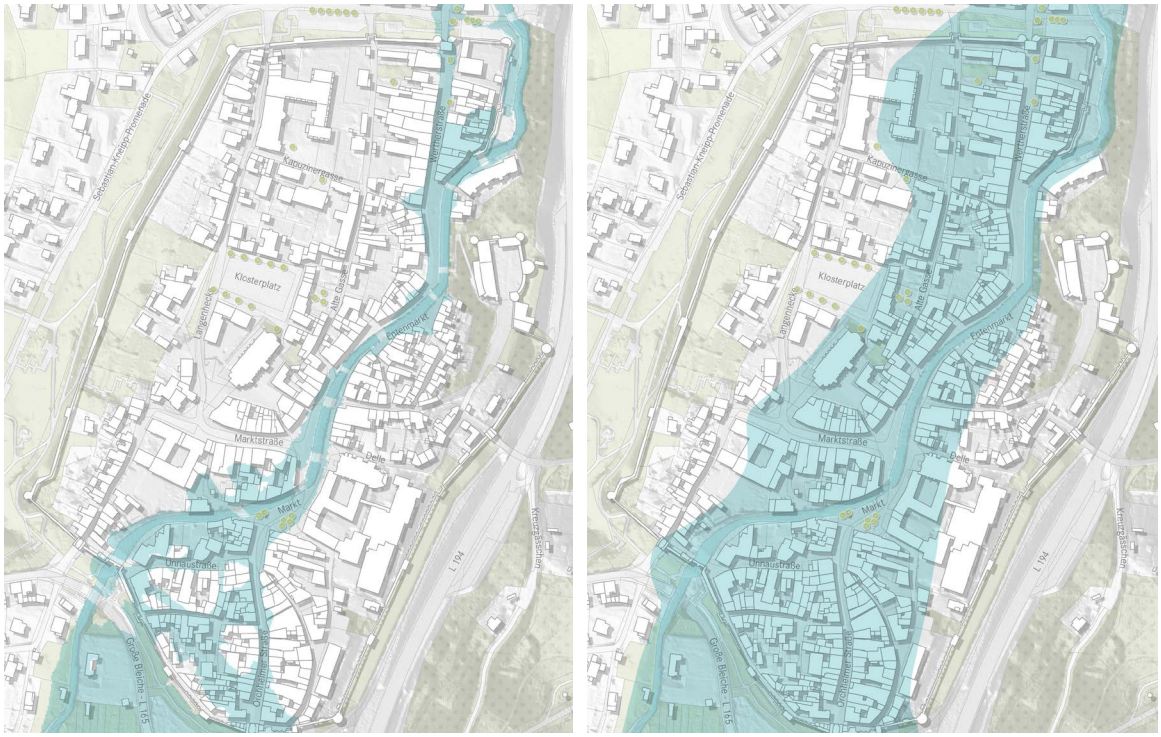


^ Fig. 2 Risk governance framework (Source: Vanessa Ziegler, 2023).

evaluating risk and managing risk. These build on each other and structure the guiding principles for the improvement of integrated risk management for cultural heritage in urban development.

Understanding Risk: Risk is More than a Function

The first step in integrated risk management, and the basis for reducing risk to cultural heritage, is to fully understand risk and all its components. Therefore, understanding risk deals especially with the development of suitable databases and assessment methods. Risk is generally understood as a function of threat or hazard on the one hand and vulnerability on the other. While threats may stem from (external) natural, anthropogenic or socio-natural processes and events (e.g., heavy rains, armed conflicts, environmental destruction or climate change), vulnerability is a result of several (internal) factors of the objects to these threats: susceptibility (e.g., age, state of preservation and building



^ Fig. 3 Comparison of the calculated extreme flood scenario with the actual flood level in July 2021 in the historic old town of Bad Münstereifel (Source: Vanessa Ziegler, 2022).

materials), exposure (e.g., location), and coping capacity (the ability of individuals, organizations and systems to handle adverse circumstances, requiring resources and long-term management). The latter includes infrastructure, knowledge and awareness. For instance, if the involved stakeholders are conscious of the need for risk management and willing to implement respective measures, this contributes to the coping capacity and lowers the vulnerability of a site or asset.

As described above, existing approaches in risk management for cultural heritage are still lacking integration. Likewise, local practitioners in urban development often lack the necessary skills and abilities to fully understand and analyze risk. Assessment methods such as the so-called "risk matrix approach" are not known or not yet systematically integrated. Therefore, the recently published BBSR (2023a) handbook provides a detailed explanation and step-to-step guidance about how to conduct this analysis.

Surely, it is important to have adequate data at hand about threats and hazards and to reduce vulnerability as much as possible to be prepared for potential disasters. But although we need to prepare ourselves, we also need to understand that there is never absolute safety and certainty and that disasters can always strike unexpectedly. Also, the probabilistic data we use in many cases are based on statistics from past events and may no longer accurately represent the present and future due to climate change. The frequency and severity of extreme weather

events can change significantly. We therefore need to update our valuation methods and find new approaches that can take changing circumstances into account. Figure 3 shows, for the case of Bad Münstereifel, how previous estimations of flood levels were exceeded by a great margin during the flood event of summer 2021.

Evaluating Risk: Finding Common Ground, Defining Resilience

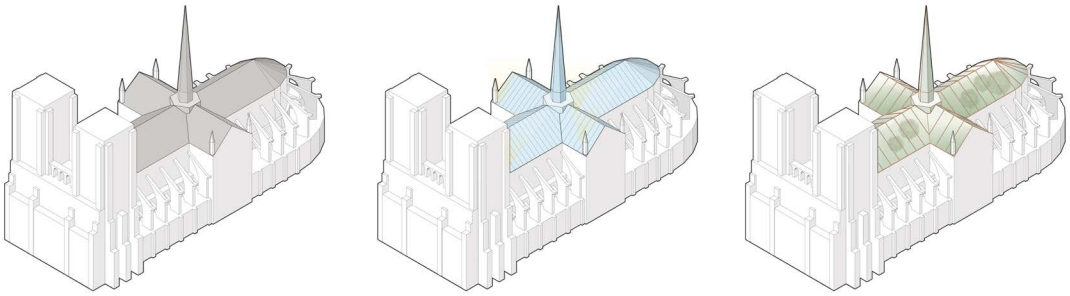
Building on the assessment and interpretation of databases, and before deciding on actual management strategies and measures, objectives and priorities for protection need to be defined. According to the previously mentioned risk governance cycle, several normative steps can be defined which require careful attention and discussion. Although such a clear normative basis for judgments and decisions is considered crucial for successful integrated risk management, in many processes, this important step is either skipped or the (unconsciously) formulated objectives and priorities are not questioned. In several cases, it is evident that sites and buildings shall be reconstructed as before; further exposition to future threats is often not considered.

The definition of objectives should therefore include the designation of both the objects of protection to be considered and the desired level of safety – or, in other words, the acceptable level of residual risk. This requires two major decisions, which should be based on inclusive, democratic discussion and sound evidence.

The first step in defining objections regarding cultural sites and assets should be to identify their architectural, commemorative, symbolic or other values (Meier 2021). Questions that might be asked include these: "Are UNESCO-listed World Heritage Sites more important (and protection-worthy) than listed monuments, which in turn are prioritized higher than non-listed buildings and sites? May some elements not (yet) be formally recognized as cultural heritage but still be important to local communities? Which rules should apply in determining protection levels?"

As a second step, the definition of normative objectives and priorities requires discussion of questions such as "Which state of the (urban) environment should be maintained during a disturbance and restored afterward?" Contributions to this discussion can be very diverse and depend on the underlying understanding of resilience in the context of local integrated risk management. We can generally differentiate between three different resilience concepts:

1. In a narrow and static understanding of resilience, focusing on rapid system restoration after disturbance limits the integrated risk management approach to "bouncing back" — that is, maintaining its status quo. This overlooks adaptive responses and potential improvements in the urban environment (Davidson et al. 2016).
2. Resilience can be considered an adaptation to multiple equilibria, "bouncing forward" while preserving the system's core identity.
3. Another transformative view emphasizes quick system transformation, allowing adaptation beyond past events. Opting for this understanding of resilience in local integrated risk management underlines its potential to achieve greater sustainability (UN-Habitat 2021). Here, "urban resilience" is defined as the "measurable ability of any urban system, with its inhabitants, to maintain continuity through all shocks and stresses, while positively adapting and transforming toward sustainability" (UN-Habitat 2021).



^ Fig. 4 Static, adaptive and transformative understanding of resilience (left to right), applied to the Notre Dame cathedral in Paris (Source: Vanessa Ziegler, 2023).

The Notre Dame cathedral restoration debates highlighted contrasting approaches, ultimately favoring "bouncing back." Previous discussions explored alternative solutions, including a "greenhouse roof" and ways of integrating biodiversity and educational spaces in urban planning (Walsh 2019; fig. 4).

Managing Risk: How to Put Integrated Risk Management Down on Paper

The final aim of integrated risk management is to implement concrete strategies and measures to protect built heritage from risk in all phases: prevention, preparedness, response and recovery. While short-term measures involve immediate actions in the sense of "first aid," like installing barriers and stabilizing structures, long-term strategies include spatial planning and structural modifications in land use, such as protecting hazard-prone zones from urban development and reducing vulnerability through building adaptations, dike construction or retention ponds.

Before implementing such strategies and measures, potential conflicts with cultural heritage should be analyzed carefully. The case of Grimma in Germany underlines the necessity of considering possible (visual) impacts: the flood of 2002 devastated the historic town, leading to the idea of a protective wall being constructed around it (fig. 5). Conflicts emerged in relation to the wall's visual impact on the heritage site. Scientific research, as well as a second flood event in 2013 that once again devastated the recently reconstructed city, supported the view that the wall was necessary. This case highlights the importance of resolving visual conflicts preemptively for effective disaster response and the need for efficient conflict to be resolved through informed debate.

To this end, multiple stakeholders, each with their own roles and responsibilities, are to be involved in the process: democratically elected decision-makers, such as the mayor, members of the town council and the public authorities for urban planning, heritage and environment; supervisory authorities, like the disaster control and monument authorities; civil society groups, such as residents, owners, local history associations, and voluntary fire brigades; and finally intermediaries like emergency networks, external engineers and experts.

^ Fig. 5 Flood defense system in Grimma, Germany (Source: Sebastian Bachran, 2022).

Conclusions

The significance of cultural heritage as a fundamental resource for urban resilience is growing in light of recent crises, notably the increasing threat posed by water-related hazards due to climate change. Fading awareness in the aftermath of crises indicates that comprehensive, long-term consciousness and strategies have not yet been sufficiently established. Such crises furthermore underline the vulnerability of our historical buildings and structures and emphasize the urgent need for holistic protection approaches.

This article has focused on integrated risk management, which is of great importance, particularly at the local (urban) level. The local context calls for precise and effective measures involving complex interaction and coordination between different stakeholders. Efforts made by heritage professionals and risk managers must be better integrated. Integrative approaches must, to respond to the complex environments of local heritage and the coupled nature of many hazards, also take into account a multitude of hazards and their interrelation – according to the "all- (or multi-) hazards approach," as explained above. Until now, separate approaches focusing on single hazards (such as inundations) have been most common.

Finally, a comprehensive examination that addresses all the different phases, threats and

types of cultural heritage is crucial for a better understanding and effective management of heritage. It is important to promote substantive discussions and to reach consensus about objectives, especially in terms of priorities and which concept of resilience to apply.

Policy Recommendations

- Intensify communication and cooperation between heritage professionals and risk managers. For instance, establish a staff unit ("task force") at the nexus of both disciplines.
- Elaborate an integrated risk management concept on the local level. Results from the analyses, defined objectives and measures should be formally adopted to guide future administrative actions.
- Establish an iterative learning process. The content of the local integrated risk management should be periodically reviewed – and updated if necessary. For example, due to climate change, prior estimations of flood levels might no longer be accurate.

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