KNOWLEDGE NOTE

Promoting Disaster Resilient Cultural Heritage

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SUMMARY

Cultural heritage holds great importance for communities around the world. Heritage—both tangible and intangible—connects us to the past and provides invaluable insights into our identities and evolution. It can play an important role in economic growth, poverty reduction, and sustainable development. In post-disaster situations, cultural heritage can also play a role in strengthening the resilience of affected communities. In spite of these benefits, there is a lack of attention for the protection of heritage from a variety of risks, including disaster risks. While the disaster risk management (DRM) agenda has advanced substantially over the past decades, currently neither national nor local DRM strategies systematically integrate protection of heritage.[1] In fact, experience shows that cultural heritage is often damaged or destroyed in the aftermath of a disaster due to insensitive conservation, recovery, and reconstruction.

Cultural heritage is vulnerable to the adverse impacts of natural disasters, and climate change is adding to the urgency of addressing this challenge. Lack of maintenance and the loss of traditional knowledge have increased the vulnerability of cultural heritage assets in many regions of the world. Urbanization and agglomeration of economic activity have also been exerting pressures, for example through changes in land use or zoning that may expose cultural heritage to additional risks. When regular infrastructure is damaged by disaster, repair or reconstruction is usually possible; but impacts on cultural heritage can be irreversible and can also lead to economic losses, including loss of livelihoods.

Countries around the world are employing a variety of measures to safeguard cultural heritage against disaster risks, drawing on relevant conventions, policy frameworks, and guidance.[2] International disaster risk reduction frameworks such as the Hyogo Framework for Action and the Sendai Framework for Disaster Risk Reduction 2015–2030 recognize the links between different aspects of culture, risk reduction, and resilience, and so provide a foundation and enabling policy environment for mainstreaming of DRM to preserve cultural assets. Many countries, including Japan, Italy, Turkey, and others, are already driving innovation and good practice in the sector. Lessons from their experience suggest there are many opportunities to safeguard heritage, avoid unnecessary loss of lives, and minimize damages and losses in economic activities.

To protect lives, livelihoods, and cultural heritage, it is important to strengthen the resilience of assets at risk and make disaster resilience an intrinsic part of cultural heritage management. Key recommendations emerging from this note are in line with the four priority areas of action identified under the Sendai Framework: improving understanding of risk, strengthening risk governance, investing in risk reduction and disaster preparedness, and supporting efforts to build back better.

- **Legal, policy, and institutional frameworks.** Strengthening the resilience of cultural heritage should be considered an integral component of a country's overall DRM strategy. It is crucial to establish an enabling legal, policy, institutional, and operational framework for resilient cultural heritage, and to outline responsibilities and coordination protocols for various stakeholders and across the spectrum of DRM practices, from risk assessment to preparedness, response, and recovery. Greater coordination between the different stakeholders, including academia, the private sector, and the local communities, is needed beyond the times of a disaster.
- **Understanding risk.** Baseline data collection and scientific identification of risks through multi-hazard risk assessments and impact scenarios are cornerstones for improved management of disaster risk facing cultural heritage assets.

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[1] According to experts at the Sendai Framework discussions, the level of attention to heritage issues is very limited (United Nations 2015).

[2] Examples include the convention concerning the Protection of the World Cultural and Natural Heritage Paris, 1972; Kyoto Declaration on the Protection of Cultural Properties, Historic Areas and their Settings from Loss in Disasters, 2005; UNESCO/WHC Strategy Document for Reducing Risks from Disasters at World Heritage Properties, 2006; and the UNESCO/WHC Addendum on Natural Disasters.

- **Risk reduction and capacity building.** A variety of measures can be taken to reduce disaster risks to cultural assets, including both physical mitigation and non-engineered solutions such as improved building codes, coordination, or site management. Data, technology, and innovative approaches can help protect monuments against natural disasters at the level defined by criteria and expected risks, for example by helping to prioritize and protect the most important heritage assets in the context of limited resources, and by identifying the right combination of measures.
- **Preparedness and early recovery.** Post-disaster recovery is a sensitive time when additional factors (debris removal, theft, misclassification, further disaster events) can amplify the impact of the initial disaster. Stakeholders need to be better prepared if they are to effectively respond to disaster impacts on heritage assets and support sensitive recovery, especially when local communities and livelihoods are closely connected to heritage sites.

THE STRUCTURE OF THE NOTE IS AS FOLLOWS.

SECTION 1 includes key definitions and lays out the context for protecting cultural heritage against the impacts of disasters.

SECTION 2 presents common challenges and a framework for managing disaster risk faced by cultural heritage.

SECTION 3 summarizes good practice and lessons learned from international experience.

SECTION 4 presents select case studies that highlight innovative approaches and solutions for strengthening disaster resilience of cultural heritage.

SECTION 5 summarizes key recommendations for policy makers and practitioners.

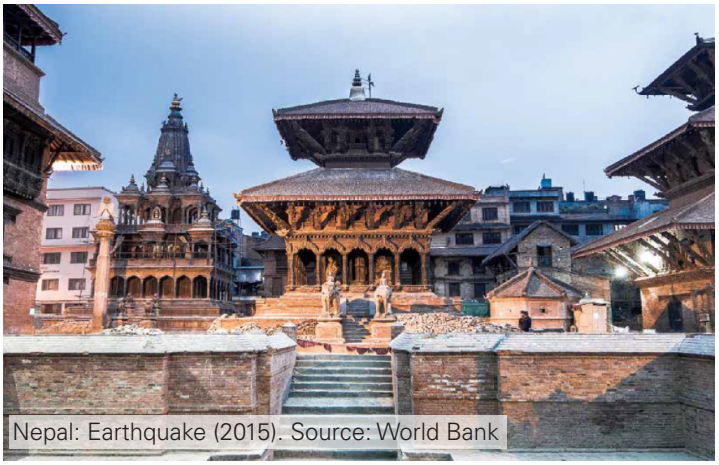
1. CULTURAL HERITAGE AND DISASTER RISK MANAGEMENT

The United Nations Educational, Scientific, and Cultural Organization (UNESCO) defines cultural heritage as "the legacy of physical artifacts and intangible attributes of a group or society that are inherited from past generations, maintained in the present and bestowed for the benefit of future generations."[3] Cultural heritage is broadly classified as either tangible or intangible. Tangible cultural heritage consists of buildings, historic places, monuments, significant artifacts, or other objects that are considered worthy of preservation for the future. These include "objects significant to the archaeology, architecture, science or technology of a specific culture."[4] Intangible cultural heritage includes "traditions or living expressions inherited from our ancestors and passed on to our descendants, such as oral traditions, performing arts, social practices, rituals, festive events, knowledge and practices concerning nature and the universe or the knowledge and skills to produce traditional crafts."[5] Intangible heritage faces considerable risks through the death of knowledge holders and practitioners, the scattering of communities of practice, and disruption to transmission systems. This type of damage often has a longer-lasting social impact than damage to built heritage. This note focuses on tangible cultural heritage, its vulnerability to natural disasters, and efforts to build resilience in heritage assets.

Cultural heritage plays an important role as a reflection of cultural, historical, and social values, and is often crucial for sustainable development. Cultural heritage is understood to be valuable to national and community identities, links to the past, and ongoing social cohesion. But cultural heritage is also important in promoting economic development and can play a key role in growth and poverty reduction; it can also contribute to sustainable development and to the resilience of communities and societies. Research is under way to explore ways of valuing cultural heritage, particularly tangible

[3] UNESCO, "Tangible Cultural Heritage," http://www.unesco.org/new/en/cairo/culture/tangible-cultural-heritage/.
[4] Ibid.
[5] UNESCO, "What Is Intangible Cultural Heritage?" https://ich.unesco.org/doc/src/01851-EN.pdf.

heritage. In parallel to practices of valuing physical capital or environmental resources *(natural capital)*, economists are imputing value to heritage assets by classifying them as "cultural resources" *(Licciardi and Amirtahmasebi 2012)*.


Nepal: Earthquake (2015). Source: World Bank

From a DRM perspective, the rationale for the protection of cultural heritage is primarily linked to protecting lives, livelihoods, and economic activity. Nepal offers a vivid example of the human and economic toll arising from the impact of disasters on cultural heritage. In 2015, a devastating earthquake killed more than 8,500 people and caused extensive damage to the World Heritage site in the Kathmandu Valley, a major center of Nepal's cultural heritage. According to the post-disaster needs assessment, "destroyed tourism-related supply of services and decreased tourist spending are likely to lead to a loss of NPR 62 billion *(approximately US$600 million)* over the next two years" *(GFDRR 2015)*. This is a significant impact on a key sector of a country where livelihoods are closely linked to preservation of cultural heritage. Related to the human impact of disasters on cultural heritage, it is also important to consider the impact on those who live or work in heritage structures such as museums, religious centers, administrative buildings, community dwellings, etc.: after a disaster, debris may interfere with emergency services and accessibility, and there is also likely to be an impact on social cohesion.

Cultural heritage is vulnerable to the adverse impacts of natural disasters. Floods, earthquakes, landslides, fires, long-term climate effects, and other natural hazards can cause damage or even total destruction of cultural heritage *(European Parliament 2007)*. Based on existing trends, it is expected that the number of disasters and their intensity will rise *(Meier, Will, and Petzet 2007)*. Climate change may also introduce new or intensified risks to cultural heritage assets, including rainstorm or rising sea levels, which may particularly impact coastal heritage assets. Because cultural heritage is not immune to these global changes, there is an urgent need to develop mitigation and adaptation strategies.

In part, the vulnerability of heritage assets relates to their location and physical characteristics, including quality of construction and conservation. As indicated above, immovable heritage assets located in coastal areas could be especially vulnerable to the impacts of climate change. On the other hand, some of the vulnerability may be structure-specific. Some assets, for example, may have undergone conservation or rehabilitation without proper strengthening or risk mitigation. Some monuments and buildings may be vulnerable due to the materials used in their construction or their architectural design. For example, mud mortar has very low bearing and stress capacity, allowing masonry structures to become rigid, not ductile to impacts such as earthquakes, and hence easily damageable. Structures with high arches or big spaces without adequate support may require extensive effort to reduce their risk. Across Asia, for instance, large masonry walls connected with vaults and arches supporting high towers face significant seismic stress.


Myanmar: Floods (2015). Source: World Bank

Beyond physical characteristics, vulnerability is also driven by the socioeconomic environment in which cultural assets exist *(Jigyasu 2016)*. Urbanization and agglomeration of economic activity have created situations in which historic heritage assets—including monuments, places of worship, or natural heritage—find themselves surrounded by new construction activity in which the work is done poorly and without an authorizing legal framework that takes proximity to heritage sites into account. In the event of an emergency, these new structures may represent an additional risk factor to cultural heritage, in part because they may limit access to affected historic areas *(Jigyasu 2016)*, which in dense urban areas are sometimes used as informal sheltering places after a disaster. Further factors that increase the vulnerability of cultural heritage include a lack of awareness of the need to reduce risks, the low priority given to cultural heritage protection, weak capacity to implement protective measures, limited coordination among stakeholders, and limited risk management of cultural assets *(Taboroff 2000)*.

Unlike disaster damage to regular infrastructure, disaster damage to cultural heritage is often irreversible; in addition to economic losses and livelihoods impacts. The adverse impacts on heritage assets can vary by the type of the underlying hazard. Flooding, for example, affects buildings through wetting and weakening. Exposure to flooding or submersion can damage or lead to settlement of foundations, causing structural instability. Floating pieces of debris can cause structural damage to buildings or destroy smaller heritage objects. Flash floods are particularly dangerous for museums and archives, particularly when parts of collections are stored underground. Earthquakes present a serious threat to historic structures, especially masonry construction, which can suffer cracks or compromised structural integrity that leads to partial or total collapse. In developing risk mitigation strategies, the specific type and combination of disaster hazards is an important consideration. **Table 1** presents a list of recent disasters that had a significant effect on cultural heritage. In each of these cases, the impact went beyond direct damage to heritage assets to include considerable economic losses.

TABLE 1: LIST OF CULTURAL HERITAGE SITES RECENTLY DAMAGED BY DISASTERS

Year	Country	Hazard	Description
2016		Earthquake	Centuries-old structures, including the cathedral and basilica of San Benedetto in Norcia and St. Augustine church in Amatrice, were reduced to rubble *(Kirchgaessner and Giuffrida 2016)*. The affected region generated €9 billion in tourist trade, part of which was directly linked to heritage sites. In the immediate aftermath of the earthquake, tourist arrivals declined precipitously *(Bartoloni and di Pillo 2017)*.
2016		Earthquake	A 6.8 magnitude earthquake struck central Myanmar in 2016, killing at least three people and damaging almost 400 Buddhist stupas/ temples dotting the plains of Bagan. This region is a centerpiece of Myanmar's tourist industry, which contributes about 3 percent to the economy and a similar share of employment *(Myint and Tun 2016)*. In addition to potential impact on income for locals, the cost of rehabilitating these temples will be significant.
2015		Earthquake	The 2015 Nepal earthquake had a devastating impact on the economy. The impact on cultural heritage was especially adverse: about 750 monuments were affected by the earthquake, including monuments on the UNESCO World Heritage List.a Economic damage and losses in the cultural heritage sector alone were over NPR 19 billion, or about US$180 million *(Government of Nepal 2015)*.

TABLE 1: LIST OF CULTURAL HERITAGE SITES RECENTLY DAMAGED BY DISASTERS (CONTINUED)

Year	Country	Hazard	Description
2013	 THE PHILIPPINES	Earthquake	Out of a total 3.2 million people affected by the 2013 earthquake, 348,000 were displaced. Many historic churches in Bohol collapsed *(NDRRMC 2013)*; damage to the churches was estimated at over US$30 million. Given Philippine religious traditions, the social impact was likely greater than the economic costs.
2011	 THAILAND	Floods	The 2011 floods killed more than 220 people and inundated over 200 ancient temples in the Ayutthaya World Heritage site and its periphery (Taylor 2011). Economic damage and losses in the cultural heritage sector were estimated at over B 7.5 billion, or about US$250 million *(GFDRR 2012)*.
2011	 JAPAN	Tsunami, earthquake	The 2011 earthquake and tsunami left approximately 19,500 dead or missing. The total number of cultural heritage properties damaged by the earthquake exceeds 1,000 *(ICOMOS 2011)*.
2010	 NEW ZEALAND	Earthquake	The Christchurch earthquake of 2011 inflicted heavy damage on the New Zealand economy, with losses estimated at about 8 percent of GDP *(Parker and Steenkamp 2012)*. Christchurch is also a gateway for tourism, accounting for 20 percent of the sector's revenues. Much of the tourism in the region is linked to cultural heritage in areas like Central City, where most of the damage occurred.

a. World Monuments Fund, "Cultural Heritage Sites of Nepal," https://www.wmf.org/project/cultural-heritage-sites-nepal.

2. BUILDING RESILIENCE OF CULTURAL HERITAGE ASSETS

Challenges to Promoting Resilient Cultural Heritage

There are many challenges to promoting resilient cultural heritage. Even as heritage assets face increasing risk from natural hazards, cultural heritage has only recently been included in the overall international agenda of disaster risk reduction. In 2007, the Strategy for Reducing Disaster Risks at World Heritage Properties was adopted by the United Nations (UNESCO 2007c). At the time, efforts were made to adapt guiding principles of the Hyogo Protocol for the preservation of World Heritage sites. The 2015 Third UN World Conference on Disaster Risk Reduction and endorsement of the Sendai Framework for Disaster Risk Reduction 2015–2030 by the UN General Assembly have set a new path, with the Sendai Framework calling for "substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries" *(emphasis added)*[6]. The challenges to promoting resilient cultural heritage identified below fall under the broad priority action areas of the Sendai Framework.

[6] United Nations, "Sendai Framework for Disaster Risk Reduction 2015–2030," http://www.unisdr.org/files/43291_sendaiframeworkfordrren.pdf.

Understanding Risk

- **Identification, assessment, and monitoring of disaster risks.** Without an institutional framework, it is difficult to manage the risks facing cultural assets. Risk identification—the first step in DRM—is difficult as well, and a lack of baseline information at all levels is a key challenge to the implementation of DRM in the culture sector. Few countries have begun cataloging cultural assets, mapping hazard risks, and placing them in the context of historical knowledge and traditions.

Mali: Annual community-based maintenance at World heritage mosque. Source: World Bank.

- **Community engagement.** There are multiple dimensions to the role played by communities in relation to cultural assets. Both residents and nonresidents may pose risks to cultural heritage, such as through social issues like dumping of waste, illegal construction, and vandalism. Because the community and technical bodies/experts may have different priorities and make different uses of sites, achieving consensus between them on emergency response, post-disaster recovery, and long-term risk reduction can also pose challenges.

Strengthening Risk Governance

- **Legal, policy, and institutional frameworks and governance.** In most countries, there are no established legal and regulatory frameworks to deal with cultural heritage issues, much less any that include DRM. There is a need to strengthen the integration of culture and DRM sectors at all levels in order to bridge institutional silos and enhance coordination among relevant institutions and actors in implementing DRM strategies and plans.
- **Jurisdiction.** The mandate for risk assessment, preservation, restoration, asset management, and reconstruction can be assigned to the national government or various levels of local government (depending on the class of asset) and can fall under many sectors/line ministries (ranging from tourism, to public works, to culture) as well as various public jurisdictions (particularly for important cultural properties), private jurisdictions, or some combination (e.g., historically significant religious infrastructure). This complexity can lead to inaction along the entire DRM cycle, including risk identification, risk reduction, preparedness, and post-disaster reconstruction, as well as to misalignment of tasks with specific agencies; for example, cultural agencies may not have the technical capacity to implement structural resilience programs.

Investing in Risk Reduction

- **Resources.** There are often limited financial resources available for the protection of cultural heritage. For example, after the 2008 recession, Italy reduced its budget for culture, and by 2011 the budget had been reduced by half over the previous three years, from US$603 million to US$340 million *(Nadeau 2011)*. In developing countries, retrofitting and other structural options for protecting heritage assets can be prohibitively expensive given competing development priorities. Financial constraints can also inhibit the adoption of technology solutions such as digitization of information pertaining to heritage assets.
- **Technical expertise.** Lack of expertise and capacity on the part of officials—particularly for planning and coordinating post-disaster needs assessments for the culture sector, conducting restoration activities in the aftermath of disasters, and carrying out risk reduction intervention—can sometimes prove more damaging than the original disaster event. Limited expertise and capacity also limit the availability of technical experts for post-disaster needs assessments or urgent recovery operations.

Disaster Preparedness, Response, and "Building Back Better"

- **Disaster response and recovery.** There is evidence to suggest that cultural heritage suffers not just from disasters but also from inadequate and uncoordinated post-disaster recovery efforts, inadequate response and contingency plans, and limited knowledge and capacity of local officials. For example, attempts to quickly remove rubble from a damaged structure can worsen the damage to assets inside the structure. As explained in **box 1**, an assessment carried out after the 2016 Bagan (Myanmar) earthquake found that many of the reconstruction efforts following the 1975 earthquake took place without full consideration of earthquake *(or flood)* protection techniques. The post-disaster interventions, which included insensitive conservation, repair, and rebuilding, contributed to the level of damage to monuments in the Bagan earthquake *(UNESCO 2016).*
- **Disaster reconstruction.** There is a need to collaborate with relevant authorities and actors at different levels during the reconstruction processes, and to promote an approach to recovery and reconstruction that considers multiple factors and priorities, such as the need to preserve culture and heritage, enhance safety and sustainability, and acknowledge the potential of culture as a catalyst for social and economic recovery.

BOX 1: LESSONS LEARNED FROM THE 2016 BAGAN EARTHQUAKE

Bagan is an important historical site in Myanmar located in a geologically active area. On August 24, 2016, some 400 Buddhist stupas and temples were affected by a 6.8 magnitude earthquake. With support from UNESCO, the World Bank, and other partners, a rapid assessment of the impacted structures was conducted; for select monuments, a detailed assessment was conducted that included options for structural stabilization and suggestions to improve Bagan's resilience. These assessments highlighted the relationship between the 2016 damage and poor-quality conservation, repair, rebuilding, and maintenance of a number of affected monuments following the 1975 earthquake. After the 1975 earthquake, which affected most of Bagan's monuments to various degrees, almost all temples and stupas were at least partially reconstructed during various phases of interventions. However, much of the past reconstruction effort took place without seismic (or other hazard) strengthening. In many cases, new structures added during the reconstruction processes created additional strain on bearing walls, adversely impacting their capacity to resist earthquakes, and leading to major damage in the 2016 earthquake. For several monuments, a number of heavy interventions *(such as metal frames and buttresses)* were implemented to improve their resilience, although their effectiveness and aesthetic are questionable. Hundreds of "new" monuments, which were built on the mounds of monuments collapsed long ago without any application of resilient measures, saw major impact in the 2016 earthquake. On the other hand, structures that were seismically strengthened in compliance with expert recommendations and proposed methods, including as part of the UNESCO/UNDP Project BUR 78/023, exhibited general good performance and suffered minimal damage.

Myanmar: Damaged temple in Bagan. Source: World Bank.

Source: Gavrilovic, Pichard, and Pottier 2016; Gallinaro 2016.

Approaches for Resilient Cultural Heritage

The field of DRM has evolved from a culture of merely responding to natural disasters to a more comprehensive framework with ex ante planning, actions, and investments. International frameworks such as Hyogo and Sendai have advanced the field of DRM across its key elements of prevention, risk mitigation, disaster preparedness, and response, as well as resilient recovery and reconstruction. This comprehensive DRM approach can be also applied to cultural heritage assets. In this approach, both structural measures (such as construction or engineering techniques) and nonstructural measures (such as laws, policies, knowledge, and capacity building) can help strengthen resilience of heritage assets.

Having an enabling governance structure for protecting cultural heritage can foster adoption of a comprehensive approach to resilient heritage *(Bianchi and Tampieri. 2016).* A legal framework should guide activities for cultural heritage and set out the responsibilities of given institutions, specify policies to coordinate the management of heritage assets, and help institutionalize resources needed to fulfill these roles. Experience shows that institutional mechanisms can support resilient approaches in this sector, including by assessing and monitoring risks, developing DRM plans, building capacity, and allocating sufficient resources to prepare and respond to natural disasters; this approach has been used in Japan, for example. In countries like Turkey, on the other hand, structural mitigation measures may be more difficult to implement due to the existing governance structure, which may require different layers of approvals, or due to the range of priorities and views held by respective stakeholders toward resilient interventions.

Once an enabling governance framework is in place, building resilience can be conceptualized. Depending on the type of asset, resilience can be strengthened using three broad strategies: (i) locational; (ii) physical; and (iii) operational. Risk reduction measures may be structural or nonstructural.

Although locational mitigation strategies cannot be easily employed for large immovable heritage such as historic buildings and religious sites, they may be appropriate for moveable assets such as artifacts, paintings, sculptures, etc. With predictions of rising sea levels, for example, moveable assets may be best placed away from coastal areas.

In the case of historic buildings and monuments and other immovable heritage, physical mitigation is an option. There is a range of performance and aesthetic-based approaches to physical mitigation interventions. Engineering techniques can help strengthen the stability or integrity of buildings and monuments against risk. They can also help increase the level of protection—for example, against floods—either through additional infrastructure such as physical barriers or through nature-based interventions. The type of physical mitigation to be applied depends on a variety of factors, such as site location and characteristics, hazard type, availability of technical and financial resources, and stakeholder views. As mentioned in the Turkey case study in section 4, state-of-the-art vulnerability assessments and 3D modeling of buildings' potential performance in a given scenario can guide the choice of specific retrofitting investments. A scientific evaluation of the capacity of strengthening devices or methodologies to protect monuments is a necessary step before developing short- and long-term strategies and technical guidance for strengthening monuments.

Physical mitigation can also take the form of traditional building techniques. Kashmir presents an example of how pre-modern construction has fared relatively well during earthquakes (*Langenbach 2010)*. Many traditional buildings in the capital Srinagar have a timber frame with masonry infill *(dhajji-dewari)*. Historical accounts of the 1885 and 1967 earthquakes indicate that the timber and masonry infill structures were safer than more rigid constructions. Similar observations were made after the 2005 earthquake, which affected Pakistani Kashmir as well. These pre-modern construction techniques were tied to the type of soil in Kashmir, which is comparatively soft and necessitated timber lacing as

a technique for providing structural integrity. Such examples suggest a role for learning from traditional techniques to make heritage and other assets resilient.

Physical mitigation strategies should be complemented by nonstructural elements. For example, recognizing that building codes can help reduce disaster risks, in 2016 the United States government launched an initiative to increase resiliency in building codes and standards and in building design *(Hill 2016)*. As a general rule, building codes need to match the most recent risk assessments, and their enforcement needs to be ensured by the relevant institutional framework. Disaster maps for communication of risks, spatial planning, or enhancing financial preparedness of government post-disaster are other examples of nonstructural mitigation measures that can help protect cultural assets or mitigate losses.

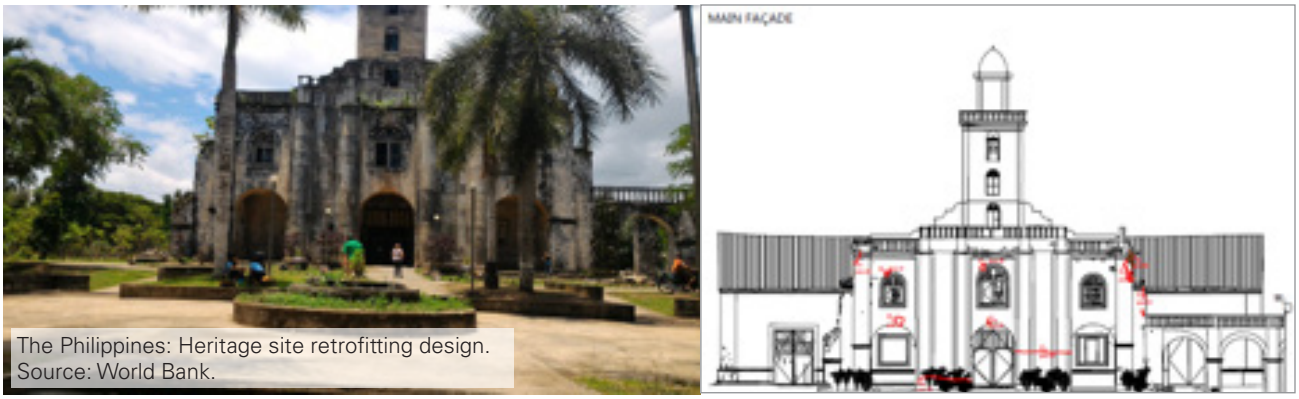
Operational mitigation focuses on disaster preparedness, recovery planning, and the related institutional setup. DRM contingency plans and drills are closely linked with building effective coordination among relevant stakeholders. Disaster recovery frameworks, which include the culture sector and which link national development strategies and plans with a general recovery vision and targets, must be prepared and agreed on by the relevant stakeholders prior to disasters to enable rapid response and effective reconstruction. Institutional mechanisms should strengthen coordination and build capacity to deal with specific issues related to heritage assets in the aftermath of a disaster.

3. LESSONS LEARNED IN PROMOTING RESILIENT APPROACHES

Ongoing practice and lessons learned can help inform broader approaches to resilience for countries whose heritage assets are highly exposed to natural hazards. Some of the good practices are listed below, along with examples from a range of countries, some of which are discussed in more detail in the **section 4** on case studies.

- **Mainstreaming heritage conservation within existing DRM policy frameworks should be done across different levels** *(local as well as national)*. As presented in the **Japan** case study, governments at all levels should include the preservation of cultural properties in DRM plans. Preservation should be recognized as an integral part of rehabilitation. Simultaneously, heritage management policies and plans must incorporate DRM policies. This will ensure a more effective approach in which stakeholders focus on respective responsibilities.
- **Data collection is necessary to inform risk reduction interventions and recovery efforts. Italy** has developed a risk map that is based on an extensive alphanumeric and cartographic database of cultural assets, and that functions as the main reference tool to safeguard Italian cultural heritage against disasters. In **Australia**, a review of the heritage conservation register, which formed the basis for protection measures and funding, found gaps and inconsistencies in the data, which affected the effectiveness of government expenditure. In response, in 2006 the National Coordinated Heritage Agenda identified establishment of data collection standards as a priority project. Australia is also an example of a country that has adopted principles for asset management in which assets are prioritized for preservation and budget allocations.

- **Multi-hazard risk and vulnerability assessments and multidisciplinary studies of heritage sites should be conducted on a periodic basis for a better understanding of risks and more effective risk mitigation investments and planning.** For example, the **Philippines** Department of Tourism, with the support of the World Bank and the Global Facility for Disaster Reduction and Recovery *(GFDRR)*, conducted a vulnerability assessment of 16 key cultural heritage sites after the 2013 Bohol earthquake and Typhoon Hayian. A detailed multi-hazard vulnerability assessment led to specific recommendations on risk reduction interventions for each structure, with conceptual designs and cost estimates for structural strengthening and restoration.



The Philippines: Heritage site retrofitting design.
Source: World Bank.

- **It is important to build the capacity of government and other stakeholders for identification and monitoring of risks, risk reduction and response to disasters, and recovery and restoration efforts.** For this purpose, the **European Union** initiated the ResCult project *("Increasing Resilience of Cultural Heritage")* as a platform allowing collaboration between government and nongovernment players to promote resilience in cultural heritage. Civil protection departments, heritage ministries, local governments, private investors, and communities can work together on preserving cultural heritage (Lingua et al. forthcoming). Lead agencies for heritage conservation need to understand DRM principles, as their contribution is vital not only for coordinating immediate post-disaster efforts, but also for ex ante asset management and risk reduction.
- **Community engagement in DRM is of great significance.** Community perceptions of risks and mitigation measures associated with a particular heritage asset may not necessarily conform to views of technical experts. After the 2011 floods in **Thailand**, for example, during the development of a flood risk mitigation plan for Ayutthaya undertaken by the Fine Arts Department with support of UNESCO and ADB, communities had a different perception of which areas of the ancient city were at highest flood risk based on the hydrological simulations. Extensive consultations had to be carried out in designing the mitigation measures to align the understanding of flood risk among the different stakeholders. Consultations are essential in arriving at a consensus, and may be especially important in bringing stakeholders together at the start of a project; so that communities can play an important role across different DRM stages, particularly risk monitoring and emergency response.

- **Networks of professionals trained in risk identification, risk reduction, post-disaster recovery, and preservation of cultural heritage should be formed.** In addition, agencies should be encouraged to collaborate with academia to promote research in this area. In **Japan**, the work of the Institute of Disaster Mitigation for Urban Cultural Heritage at Ritsumeikan University (R-DMUCH) is recognized globally for its training of professionals across the world, and for its knowledge-sharing and capacity-building efforts in Japan and beyond.
- **Given uneven expertise, sharing lessons and knowledge across countries proves valuable. The Recognition of Best Practice in World Heritage Management** is an initiative commissioned by the World Heritage Committee under which World Heritage properties shared their examples of "new and creative ways of managing their sites." This friendly competition exposed 23 World Heritage site managers to practices in other countries and helped create a body of knowledge on resilient cultural heritage. Incidentally, the Historic Town of Vigan in the **Philippines** was chosen as a best practice with limited resources, local community participation in conservation and management, and a "multi-faceted approach to site protection."[7]
- **Standard operational guidelines can serve as a point of reference for resilience activities.** Standard guidelines exist either at an institutional level or at a national level, and can help guide activities from planning and response to restoration and rebuilding. For example, the British Library in the **United Kingdom** has a contingency plan in case of emergencies. Many historical sites include a DRM plan as part of their overall site-management plan. Where heritage sites are located in populated areas and could serve as informal temporary shelters for disaster-affected residents, arrangements should be made to avoid additional damage linked to that use.
- **IT/new technologies offer great potential.** The latest geospatial technology can be used in support of cultural heritage preservation. An agreement between UNESCO and UNITAR *(United Nations Institute for Training and Research)* will focus on prevention and capacity development in this area. Satellite imagery can be very helpful in DRM activities, and it is now being used in efforts to protect heritage sites *(UNITAR 2015)*. Drones are now proving useful in efforts to respond to disasters. During the 2015 **Nepal** earthquake, several agencies used them to "map out toppled monuments, ruined heritage sites and devastated homes" *(Sharma 2016)*.
- **Cultural heritage restoration can aim to build back better.** In the aftermath of a disaster, there are opportunities to restore heritage structures with an eye to protecting them from future disasters. **Georgia** and **Turkey** provide good examples of such an approach. In 1998, the World Bank supported Georgia's preventive conservation efforts by financing stabilization of buildings, archiving of old manuscripts, and recording of traditional songs and dances. In Turkey, the World Bank-supported Istanbul Seismic Risk Mitigation and Emergency Preparedness *(ISMEP)* project financed earthquake risk assessments, performance assessment of assets, and seismic retrofitting designs at multiple heritage structures. Through the range of risk reduction measures, the project went beyond the build back better approach, introducing a new culture of resilience into the sector.

[7] UNESCO, "Sharing Best Practices in World Heritage Management," http://whc.unesco.org/en/recognition-of-best-practices/.

4. CASE STUDIES

The case studies presented here provide insights into how countries reacted after disasters or improved their framework on resilient cultural heritage.

CASE STUDY 1: ITALY'S RESPONSE TO DAMAGE FROM EARTHQUAKES

Country Italy

Nature of Heritage Small village churches, clock towers, frescos, mosaics, stained-glass windows, sculptures, and other icons of rural identity

Disaster Risks Earthquake

Context Italy is home to some of the world's richest cultural heritage. It is also an earthquake-prone country, with 111,573 people affected in the last 10 years (GSMA 2017). Italy has developed a risk map based on an extensive alphanumeric and cartographic database of cultural assets distributed across the territory. This database is the main reference tool to safeguard Italian cultural heritage against disasters. The devastating 6.2 magnitude earthquake in Central Italy in 2016 not only claimed 296 lives but also gravely damaged more than 50 historic sites in seismically active areas (Pitrelli and McAuley 2016). The earthquake destroyed historic buildings in the three towns of Amatrice, Accumoli and Arquata del Tronto.

Approach Within the context of the different risk reduction strategies discussed earlier, the Italian case highlights the need for operational readiness for a disaster. As part of first response to the 2016 earthquake, Carabinieri officers from Comando Tutela Patrimonio Culturale, better known as the "art squad," rescued pieces of art and artifacts in churches and museums (Livesay 2016). A UNESCO-trained Culture Ministry task force collected, packed, and transferred artifacts to warehouses for preservation and early damage assessment (Povoledo 2016). Restorers with the "art squad" collected ancient stones and bricks from the rubble for reuse in reconstruction.
To strengthen disaster resilience and collaboration between government and nongovernment players, the Italian Government has become an important partner of the newly created ResCult platform ("Increasing Resilience of Cultural Heritage"), which is funded by the European Union. ResCult allows civil protection departments, heritage ministries, local governments, private investors, and communities to work to preserve cultural heritage within the overarching Sendai Framework. ResCult will develop a European Heritage Map as well as a log of disasters and their impacts. It will also help monitor and model risk scenarios associated with different hazards and help design prevention strategies (UNISDR 2017). Italy, with its vulnerability to disasters and its rich cultural heritage, is expected to be a key partner for this initiative.

Challenges Faced While Italy is a leader in modern techniques for improving earthquake resilience, such as seismic isolation for infrastructure, interventions in cultural heritage sites present challenges. Given people's deeply felt historical connections to the assets, there are restrictions on how extensively seismic isolation techniques can be used and a general desire for "reversible" techniques (Parducci 2000). The other challenge is to deal with the large number of such assets in countries like Italy. Since structural measures have not been mainstreamed in Italy, reliance on nonstructural methods as seen in the response to the 2016 earthquake will continue to be important.

Good Practices/ Lessons of Experience

- **Cross-functional teams with experience in collaboration and project management can be huge assets for cultural heritage resilience efforts.** In this case, firefighters were experts in entering earthquake-damaged buildings and in retrieving artifacts; the "art squad" was trained to secure the artifacts and guard against theft; and conservationists were experts in cataloging, storing, and restoring artifacts *(PRI 2016)*. Experts worked on emergency restorations in a warehouse of the State Forestry Corps *(Povoledo 2016)*.
- A big challenge was the difficult terrain in remote areas and danger of further collapse of already-weakened structures, which inhibited access to many damaged churches and palazzos. Extreme weather (heavy snowfall) compounded the challenge. **Given such constraints, a prioritization exercise assumes critical importance.** This exercise methodically documents the damage so that officials can determine what heritage may be lost and where there is still an opportunity to retrieve and restore cultural assets. This work is linked to the database of cultural assets maintained by the government.

CASE STUDY 2: TURKEY'S INVESTMENTS IN DISASTER PREPAREDENESS IN CULTURAL HERITAGE

Country Turkey

Nature of Heritage Museum collections

Disaster Risks Earthquake, flood

Context Due to its tectonic and geological nature, topography, and meteorological features, Turkey is vulnerable to natural hazards such as floods, droughts, landslides, and earthquakes.

Approach Turkey's approach to heritage buildings and museum collections is noteworthy for its reliance on both structural and nonstructural techniques and its adoption of site-specific as well as institutional and operational mitigation strategies. The Istanbul Seismic Risk Mitigation and Emergency Preparedness *(ISMEP)* project developed an earthquake risk assessment of the collections, conducted an earthquake performance assessment, and prepared structural seismic retrofitting designs at multiple heritage structures, including the Mecidiye Kiosk at the Topkapi Palace, one of the most visited museums in Turkey. The project completed a GIS-based inventory of some of the most prominent heritage buildings—the first such effort carried out for historical buildings in Turkey. The database includes digitized archive data, sketches, and probabilistic vulnerability assessments of 176 historical buildings located in 26 historical complexes in Istanbul. This database is available to the Ministry of Culture, other public agencies, academia, and the public, and is considered a good practice by UNESCO *(World Bank 2016)*. Under the project, retrofitting designs were developed for three critical cultural heritage buildings in Istanbul *(Aya Irini, Archaeology Museum, and Mecidiye Kiosk)* based on state-of-the-art seismic vulnerability assessments and 3D modeling of the buildings' potential performance in a major earthquake. Seminars, workshops, and meetings were organized to debate proposals for building resilience. A decision was made to adopt multiple low-cost mitigation methods, including innovative retrofitting of buildings within the Topkapi complex. Smaller-scale risk mitigation measures included anchoring storage cabinets to the wall, moving heavy objects from higher shelves to lower ones, wrapping of ceramics, etc. In 27 museums, procedures using security films, safety hooks, and locks were adopted to protect paintings in storage rooms from unfettered movement and to keep showcases from breakage during an earthquake. The 2006 opening of the Storage Museum—a dedicated separate building for storing palace collections in a risk-mitigated manner—was another landmark effort (European Union 2016). On the policy front, Turkey changed its DRM structure in 2009 and established the Disaster and Emergency Management Presidency (AFAD) under the Prime Minister's Office. It is responsible for organizing the National Platform for Disaster Risk Reduction, which streamlines DRM and facilitates cooperation among stakeholders, including government bodies, scientists, nongovernmental organizations, private business, and local communities. Training plays a major role in Turkey's approach to DRM. Initiated in 2000, the Disaster Preparedness Education Program has helped to develop many projects, trainings, and meetings. The Museum Studies Graduate Program under the Faculty of Art and Design of Yildiz Technical University worked to raise awareness about museums' exposure to earthquake risk. A group of academic institutions, museums, and government bodies designed a distance learning program.

Challenges Faced Turkey's governance mechanism for cultural heritage preservation ensures a careful review process for any intervention. Within this process, different priorities and viewpoints on the appropriate degree of intervention or modification to historical assets impact investment choices. For example, the retrofit designs developed by ISMEP for the Museum of Archaeology and Mecidiye Kiosk were reviewed and approved by the Istanbul Preservation Board for Cultural Heritage and Monuments, and retrofit work is ongoing; but proposed retrofitting designs developed for the Aya Irini monument are awaiting approval from the Istanbul Protection Board. Regarding museum storage, overcrowded display cases and storage areas, improper shelf loading of exhibits, and unrestrained objects all complicate effective response in case of disaster.

Good Practices/ Lessons of Experience

- **The ISMEP project presents a comprehensive approach to improving disaster resilience** of important cultural heritage, encompassing risk identification, multi-hazard risk reduction, training and stakeholder consultations, scientific modeling and technical guidance for specific mitigation measures, and the successful implementation of a combination of structural (engineered) and nonstructural measures.
- **Well-designed learning programs** to train staff and provide skill sets at the intersection of DRM and cultural heritage conservation are needed.
- **Museums can benefit from DRM measures**, such as creating a database of properties, maintaining a prioritized list of artifacts, identifying areas for safekeeping, and putting a governance structure in place for coordinated efforts. This approach helps to ensure that preservation work can proceed smoothly after a disaster strikes.
- With new knowledge and evolving disaster risks, **heritage management and preservation should be open to considering new and existing resilience strategies and techniques**.

CASE STUDY 3: INTEGRATING CULTURAL HERITAGE INTO JAPAN'S NATIONAL DISASTER MITIGATION AND RESPONSE MECHANISM

Country Japan

Nature of Heritage Temples, shrines, and castles

Disaster Risks Earthquake, flood, fire

Context Japan has a long history of managing disasters. The Kobe earthquake of 1995 (6,000 deaths) and the 2011 tsunami (15,000 deaths) are two recent examples of disasters from which Japan recovered through a "build back better" approach (Garcia 2016). Japan's governance system relies on strong coordination of national and local governments guided by respective legislation and funding procedures.

Approach The Japanese case highlights a comprehensive approach to building disaster resilience. The approach includes strategies that involve locational, physical, and operational aspects. The institutional framework for DRM lies in the Disaster Countermeasures Basic Act[8], and the implementing agency is the Central Disaster Management Council. Japanese laws define six classifications of cultural properties: tangible cultural properties, intangible cultural properties, folk cultural properties, monuments and sites, cultural landscapes, and groups of traditional buildings. Financial assistance depends on the property's classification. Disaster risk reduction measures for heritage properties are divided into three major areas, fire prevention, crime prevention, and environment conservation to protect cultural heritage (UNESCO 2015). Since 2007, local governments in Japan have been encouraged to develop an exhaustive list of cultural heritage within their territories. This list will capture heritage left undesignated within the national or international frameworks, but nevertheless of critical importance at the local level. Local governments are assisted in heritage protection, but during emergencies an integrated heritage rescue approach is followed. The Institute of Disaster Mitigation for Urban Cultural Heritage's work at Ritsumeikan University (R-DMUCH) builds needed human resource capability and is recognized globally for training professionals across the world. In many parts of the world, the reconstruction of damaged historical structures focuses on preserving the "original" to the extent possible, but Japan also emphasizes the conservation of knowledge, techniques, and materials used to build the structure.

Challenges Faced Without systems for preserving historical records, those kept in private collections are particularly vulnerable and at a high risk of disappearing during disasters.
Due to lack of process-level preparedness and governance clarity, efforts to rescue cultural heritage properties did not begin until 20 days after the Great East Japan Earthquake and tsunami in 2011.

Lessons of Experience

- **Governments at all levels should include the preservation of cultural properties in disaster risk management plans.** Preservation should be recognized as an integral part of rehabilitation.
- **Systematic documentation of cultural heritage, preferably in digital format, is necessary even at the local level.** Capacity building and funding arrangements are needed to enable local governments to fulfill their roles.
- **Collaborative activities with local communities** during normal times, with participation by owners of historical records, residents, government officials, and experts, should be undertaken to institutionalize mechanisms for preserving cultural assets.

Japan: Demonstrating firefighting at heritage site.
Source: World Bank.

[8] Ministry of Foreign Affairs of Japan, "Disasters and Disaster Prevention in Japan," http://www.mofa.go.jp/policy/disaster/21st/2.html.

CASE STUDY 4: MITIGATING CLIMATE RISKS AND HUMAN-INDUCED RISK IN RESILIENT RECOVERY PROGRAMS

Country Peru

Nature of Heritage Palaces (friezes, reliefs, and carvings)

Disaster Risks Earthquake, excessive precipitation (El Niño), flood

Context Located in the city of Trujillo, Chan Chan Archeological Zone houses the erstwhile capital of the ancient Chimu Kingdom and is one of the largest and most important pre-Hispanic earthen architecture cities in the Americas. Its earthen structures are vulnerable to natural erosion and require substantial conservation efforts on a continuous basis (UNESCO 2007a). It was included in the list of World Heritage in Danger in 1986.[9] Climate change has accelerated the pace of erosion at the Chan Chan site, and the role of El Niño has been much studied in this context. Peru periodically suffers from particularly harmful El Niño effects (every 25–50 years), resulting in loss of revenue in fisheries and destruction of infrastructure. The intense precipitation from these events results in greater humidity in lower parts of the earthen structures, which causes deterioration of the base. Increased levels of groundwater due to behavioral shifts and changes in irrigation technology also contribute to erosion at this site.

Approach The Chan Chan case shows use of all three resilience strategies—locational, physical, and operational. In 1996, Chan Chan hosted a conference, jointly organized by the government of Peru, International Organization for Conservation of Cultural Heritage, and other international conservation organizations, which directly benefited the preservation of and management planning for the site. An emergency fund was allocated in 1997 to implement immediate measures against devastating impacts of the El Niño projected in 1998, and a master plan was also developed. In 2009, tent-like protective structures were erected in various parts of the city to preserve the site, and some friezes were hardened while others were photographed and then covered (Hathaway 2009). As a long-term measure, reinforcement and stabilization of the foundations and structures is under way. These works combine the best of traditional preservation practices and modern engineering techniques (UNESCO 2007a). They are managed by the Ministry of Culture through the Special Project of the Chan Chan Archaeological Complex–PECACH. In 2014–15, approximately US$7 million was spent on 53 archeological sites along the coast, including Chan Chan, which received US$0.6 million. Palaces (including Nik-An Palace) have a permanent conservation program and protective infrastructure against climate decay.

Challenges Faced The main uses of the buffer zone (area surrounding the core and restricted zones) include housing, agriculture, garbage dumping, etc.; they thus encourage urban expansion toward the site and increase the challenge of preservation. Human-induced problems of encroachment and illegal occupation inside Chan Chan are becoming more frequent and damaging.

Good Practices/ Lessons of Experience

- **Establishing a dedicated plan for the executing entity improves the continuity of implementation.** An important cause of damage from erosion is lack of continuity in conservation works that were successfully initiated years ago.
- At archeological sites like Chan Chan, where the area surrounding the core and protected areas is inhabited by the local community and used for business and agricultural purposes, **a buffer zone needs to be regulated through a legislative framework.** Collaboration with respective municipalities should be a priority to address the issues of illegal occupation and activities at the property (UNESCO 2007b).

[9] UNESCO, World Heritage Convention, "Chan Chan Archaeological Zone," http://whc.unesco.org/en/list/366.

5. CONCLUSION AND RECOMMENDATIONS

As awareness of disaster and climate risks increases, so does awareness of risks to cultural heritage. Damage and destruction of high-profile heritage sites—for example, in Japan, Myanmar, Nepal, and Turkey—have drawn attention to the need to build resilience in these valuable assets. The commitment by countries around the world to invest in DRM in this sector demonstrates their understanding that building resilience can reduce risks of future losses. Experience has shown that without awareness of and sensitivity to the special requirements of heritage assets, recovery and restoration operations can cause greater damage than the disaster event itself.

This note highlights a number of recommendations that can help policy makers and practitioners further develop DRM practices for more resilient cultural heritage. The recommendations correspond to the priorities for action identified under the Sendai Framework and address key challenges presented in **section 2** of this note. Stakeholders need to develop capacity across all these areas to ensure that respective investments are sustainable.

Understanding Risk

- **Risk assessment.** As a first step in managing disaster risks, countries need to better understand the risks to cultural heritage. This includes understanding the probability of a disaster event as well as its likely severity. To help stakeholders make time-sensitive decisions, risk mapping can be combined with modern databases of cultural assets that include information on assets' value and location.

Strengthening Risk Governance

- **Legal, policy, and institutional framework.** The contribution of heritage to sustainable development—and hence the importance of preserving heritage—needs to reflected in legislation and in policy and institutional frameworks that effectively link cultural heritage assets and DRM.
- **Coordination.** In the aftermath of a disaster, coordination among government agencies as well as other stakeholders is vital. Effective coordination at the earliest possible opportunity can prevent irreversible losses to precious cultural heritage.
- **Community engagement.** Ensuring coordination with local communities is extremely important. In some cases, the goal is to raise awareness of the assets' importance, and in other cases it is to let communities lead preservation efforts, including in the aftermath of disasters.
- **Building codes and guidelines.** Building codes should ensure resilience as well as compatibility with vernacular building practice and characteristics. The process of developing appropriate building codes and technical guidelines may include harmonizing designs and building materials of new structures with local cultural and natural heritage.

Investing in Risk Reduction

- **Site protection.** In regions of important cultural heritage, site-specific DRM plans should be developed and should consider a range and combination of primary and secondary risks. In line with these plans, invest in the structural integrity of sites.
- **Movable heritage.** Storage facilities that are resilient to hazards such as blunt force and fire can be used for movable heritage properties. These facilities can also protect from theft.

Disaster Preparedness, Response, and Building Back Better

- **Preparedness and early recovery.** Being prepared to respond in the event of a disaster is a prerequisite to effective early recovery operations. Preparedness is particularly important when there is post-disaster debris to be cleared and demolition takes place.
- **Damage assessment.** Before a disaster event occurs, governments should develop the capacity to conduct damage and loss assessments and should have a pool of experts who could be contacted in case of need. Preparations for conducting damage assessment are linked to investments in heritage databases, multi-hazard assessment, and disaster response planning prior to the disaster. Robust results of damage assessment along with other information can guide prioritization of response efforts following a disaster.
- **Post-disaster reconstruction.** Disasters offer opportunities to use modern building techniques and forms. Careful analysis of available options for reconstruction is needed to satisfy priorities of safety and heritage conservation. In some instances, traditional building techniques prove relatively resilient to natural disaster impacts; in others, modern technologies are necessary to preserve the integrity and sustainability of cultural heritage assets. Note that care must be taken to minimize disruptions to livelihoods in situations where communities have long-standing economic ties to heritage sites.

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