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Post-disaster damage assessment of cultural heritage: Are we prepared?

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ABSTRACT

Between 2013 and 2016, eight natural hazard events (one typhoon and seven earthquakes) caused death and destruction in the Philippines, Nepal, Myanmar and Italy. These disasters devastated large parts of the territory in the affected countries and resulted in the widespread damage of movable, immovable and intangible heritage. Representing the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM), the author was invited to assist with the post-disaster assessment of damage in the Philippines, Nepal and Myanmar. While in Italy she liaised with the Department of Civil Protection and the relevant cultural agencies to assess the immediate risks to the cultural heritage of the affected area. Based on these experiences, this paper highlights some critical gaps in the existing capacity that prevent timely post-event assessments of the impacts on cultural heritage, which in turn hampers its recovery.

INTRODUCTION: POST-DISASTER DAMAGE AND NEEDS ASSESSMENT

In the aftermath of large-scale, sudden-onset disasters such as the earthquakes that struck Nepal in 2015, a multi-cluster/sector initial rapid assessment (MIRA) is usually rolled out (IASC 2012). The aim of MIRA is to identify the immediate humanitarian needs on the ground, such as food, water and shelter. This assessment also takes into account the damage caused to the vital infrastructure of the country, such as roads, bridges, communication systems, electricity grids and so on. Based on the primary data collected at the moment of the crisis, and the secondary data collected both pre- and post-disaster, MIRA is undertaken within the first 72 hours of an emergency. In Nepal, 1,700 volunteers of the Nepal Red Cross Society carried out MIRA and although it was not comprehensive, it did give an initial estimate of the extent and the impact of the disaster (Nepal Red Cross Society 2015). This initial assessment in Nepal was used to launch a UN flash appeal for $422 million (Financial Tracking Service) to provide immediate relief. It is pertinent to mention here that MIRA does not include an assessment of the damage caused to cultural heritage assets. A commonly cited reason is that cultural heritage is much more complex; it requires a site-by-site assessment and, therefore, cannot be carried out within the first 72 hours of a complex emergency.

Once the relief phase is over, and the immediate needs for food, water and shelter are met, a post-disaster needs assessment (PDNA) is carried out. Led by the government of the affected country, PDNA is carried out after one month and, in the event of a complex emergency, after three months. It involves all sectors, including culture, and is meant to provide a sector-by-sector analysis of the damage, losses, ongoing risks and resources required for full recovery (Jones 2010). PDNA is used to launch a consolidated appeal for financial aid from other countries and donor agencies.

Post-disaster damage assessment of cultural heritage therefore forms a part of PDNA and, ideally speaking, should help to establish cost estimates for recovering both tangible and intangible heritage. Yet, in actual practice, a timely and accurate estimation of damage and losses for cultural heritage in the aftermath of a large-scale disaster remains problematic.

Figure 1. The oldest building of the National Museum of Nepal suffered extensive damage and contained a large collection that had to be evacuated

Figure 2. Nepalese military personnel evacuated collections from unsafe museum buildings without prior knowledge of their exact location and size

At the same time, the heightened awareness of the need to protect cultural heritage from conflicts and disasters has resulted in the development of several technology-based monitoring and documentation tools, software and apps: 3D laser scanning for reconstruction purposes; drones for aerial photography; crowdsourcing apps for collecting and visualising information on damage to cultural heritage; and satellite monitoring for tracking looting or the deliberate destruction of sites. Undoubtedly, such tools and apps have made data collection during an emergency easier. Nonetheless, a general lack of emergency preparedness, combined with specific gaps in capacity, prevent cultural institutions from optimising their use and obtaining the required information, as explained in the following sections.

POST-EARTHQUAKE DAMAGE AND NEEDS ASSESSMENT FOR CULTURAL HERITAGE IN NEPAL

One of the major challenges in undertaking rapid damage assessment of cultural heritage is the lack of available baseline data as well as systems to track, compile, analyse and visualise the multiple forms of post-emergency data. For example, when, on April 25, 2015, the first earthquake struck Nepal, the Department of Archaeology had mainly paper-based documentation for heritage sites and collections, kept in individual files, and a master list of all the sites and cultural institutions was not readily available for the emergency responders. Moreover, information such as how many sculptures, objects or collections were housed in temples, monasteries and monuments was not complete.

In the immediate aftermath of the earthquake, structural engineers carried out a survey on the safety of historic buildings and classified them as red (unsafe), yellow (safe to use, but after structural repair), and green (safe to use). In the case of many museums, including the National Museum of Nepal and the Tribhuvan Palace Museum located in the capital Kathmandu, buildings that were tagged ‘red’ had the most valuable collections. To evacuate the objects from these unsafe buildings, emergency responders needed floor plans indicating their exact location, but this information was not available at the time (see Figures 1 and 2).

Furthermore, as 750 sites were affected, it took the Department of Archaeology some time to prepare assessment teams and provide them with a damage assessment form. It should be noted that initial assessment was geared mainly to gather data on built heritage. This was because many historic structures, including those inscribed on the World Heritage list, had suffered major structural damage and the department had trained architects who were leading the process. Concerns for movable and intangible heritage were thus not fully integrated into the first assessment.

At the international level, reports about the damage to cultural heritage were made public mainly through social and electronic media. However, many reports overlapped and a clear picture remained elusive. In order to get a clear situation overview, ICCROM, together with the International Council on Monuments and Sites and its International Scientific Committee on Risk Preparedness (ICOMOS-ICORP), launched the Kathmandu Cultural Emergency Crowdmap. The aim was to gather on-the-ground reports on

Figure 3. Photo received through the Kathmandu Cultural Emergency Crowdmap showing the Nepalese military engaged in a salvage operation at a world heritage site. Photo credit: Tapash Paul/Drik

damaged heritage through heritage professionals and citizens. Empowered by Ushahidi, Crowdmap is an application that can be customised to crowdsource the desired information from social media platforms and news websites. Through a web interface, in-crisis data, including photos, can be collected from emails, multimedia messages (mms) and web reports. The data can be sent and uploaded in real time, which is helpful in generating a timeline of events during an emergency.

This initiative was successful in gathering valuable information thanks to the contributions of several institutions, namely the Smithsonian Institution, USA, the Disaster Relief Task Force of the International Council of Museums (ICOM-DRTF) and the UNESCO office in Kathmandu, Nepal. The comments on social media by cultural heritage professionals working in Nepal helped in gathering reports of damage to cultural heritage beyond the Kathmandu Valley. In 15 days, over 100 credible reports of damage to movable, immovable and intangible heritage were collected. Based on the data gathered, ICCROM and its partners were able to produce a situation overview report (ICCROM, ICORP 2015) that not only listed damage but also identified communities and emergency actors who were engaged in providing first aid to the damaged cultural heritage.

Nonetheless, the information gathered was not especially complete. The photos uploaded onto Crowdmap often lacked details such as the exact location of the damaged structure or collection. Some photos showed Nepalese military personnel clearing the debris from World Heritage sites, but additional details about these operations were missing. For example, under whose supervision the debris was being cleared (Figure 3). Had anyone quickly documented the situation before clearing the debris? The primary lesson learnt from this experience was that such applications should be introduced and tested before the disaster strikes as the user community has to be familiar with them in order to gather useful data during an emergency.

ICCROM and its partners shared the information gathered with the Department of Archaeology and Kathmandu Living Labs, an IT company in Nepal which had designed an app for UNESCO's Kathmandu office for damage assessments outside the Kathmandu Valley. The app was put to use one month after the earthquake and involved 90 volunteers, who were first trained to use the app on a smart phone (Kathmandu Living Labs 2015). The initiative was ground breaking, yet the Department of Archaeology did not have the software to access the data gathered by the volunteers. The collating, analysis and visualisation of the data gathered remained an issue throughout the initial damage assessment phase as the Department of Archaeology lacked both software and hardware to benefit from the latest technology. Overall, the lack of readiness – in terms of trained personnel, data gathering tools and previous documentation – to roll out an at-scale initial assessment delayed subsequent actions taken to secure and stabilise tangible cultural heritage, thereby compounding damage and increasing recovery costs. As a result, when the post-disaster needs assessment (PDNA) for cultural heritage and other sectors was commissioned, accurate cost estimates for damage and losses to cultural heritage were not available. In this assessment, the damage to tangible cultural heritage was estimated at

Figure 4. The traditional dance form of the Jirel people depicted in this photo may have been affected as the villages of the practising communities were destroyed in the 2015 earthquake

Figure 5. The Sulamani Temple, one of the oldest temples in Bagan, suffered extensive damage to its structure and interior objects due to the 2016 earthquake

Figure 6. File folders in boxes containing damage assessment forms for over 400 temples and pagodas collected by the Myanmar Department of Archaeology and National Museums

169 million USD (NPC 2015). This amount does not include damage to intangible cultural heritage assets (Figure 4).

POST-DISASTER DAMAGE ASSESSMENT IN MYANMAR

On August 24, 2016, a 6.8-magnitude earthquake struck Myanmar. Tremors were felt in its recently built capital Naypyidaw and there was some damage recorded to the buildings. However, the archaeological site of Bagan suffered major damage. This site is located in the Mandalay region of Myanmar and it has over 2,000 pagodas, temples and monasteries, many of them in active use (Figure 5). It is one of Buddhism's most sacred sites. Over 300 temples and pagodas were damaged due to the earthquake. The Department of Archaeology and National Museums (DOANM), assisted by UNESCO's Myanmar and Bangkok offices, launched an initial assessment.

DOANM employed five mixed teams composed of archaeologists, structural engineers, documentation experts and wall painting conservators to undertake an on-site survey and to assess the damage. The teams used a damage assessment form that had been prepared in consultation with the UNESCO Bangkok office. Additionally, all five teams recorded damage at each temple site with the help of several photos.

The Bangkok office of UNESCO invited ICCROM to evaluate the workflow for damage assessment and by the time the invited team of experts reached Bagan, i.e. on September 6, 2016, the DOANM had assessed 414 temples and prioritised 41 structures for immediate intervention. The priorities were defined on the basis of the significance of the heritage structure and the degree of damage. Forms were filled manually and the information gathered was later registered on electronic forms filled according to the inventory number of the temple (Figure 6). The photos were organised in separate folders, again named according to the temple inventory numbers. It is to be noted that the five survey teams gathered a large amount of useful information in a very limited time, which attests to the in-depth field experience and efficiency of the staff involved.

As the ICCROM team was asked to provide suggestions for possible improvements in the assessment process, the team assessed six groups of temples: Sulamani, Thy Kya Bone, Ta Yoke Pyay, Dhamma-yangyi, Swe Daw Myo Daw and Kyaung-Gyi-Ni-Ma. The assessment forms filled by DOANM were compared with the expert team's own assessment for three of the temples – Ta Yoke Pyay, Swe Daw Myo Daw and Kyaung-Gyi-Ni-Ma. The expert team also took time to interview DOANM staff involved in carrying out the initial damage assessment. The preliminary findings of the ICCROM team are reported below:

a) It seems that the survey teams did not use floor plans and site maps to indicate the location of major damage and available access routes. This information is crucial for planning subsequent security and stabilisation measures at the site and evacuating religious objects inside the temples.

b) Ideally, the numbers of the photos showing specific structural damage should be indicated on the key drawing or floor plan of the temple,

Figure 7. Professionals in Myanmar learning how to use site maps to locate damage during an on-site damage and risk assessment led by ICCROM

which facilitates the processing of information off-site. Moreover, DOANM assessment teams had taken multiple photos, which made the process of matching the photos with the specific damage mentioned in the individual forms very tedious.

c) The forms filled by the DOANM team did not provide sufficient information on immediate risks. For example, due to the out-of-plane displacement of walls and delamination at several temple sites, heavy rain can compound the damage and cause localised structural collapse. Moreover, the team recorded damage to the wall paintings and decorated surfaces, but they did not record areas where paint surfaces had lost adhesion and were at the risk of detaching completely due to aftershocks or structural interventions.

d) Usually an initial assessment should also provide information on the immediate security measures needed at a site before inviting workers/volunteers to sort debris. Such information, however, was not recorded in the assessment forms, which were translated for the ICCROM team. For example, at the temple sites that the expert team visited, surface decoration fragments were strewn all over and should have been collected as well as documented before providing access to the volunteers for sorting the debris.

e) The expert team discussed the criteria for identifying priorities for intervention with various members of the DOANM survey teams. It appeared as if there was some confusion about the criteria used. Some members identified the significance of the temple as the most important criterion, while others thought that the degree of damage was the most decisive criterion for prioritising intervention.

Based on the above findings, the ICCROM team suggested the use of a site plan or key drawing to indicate the locations of major damage, access routes and the surrounding areas which could be used to create on-site temporary storage for old bricks and building fragments. Furthermore, in order to shorten the time needed for matching photos to the information recorded in the forms, the expert team advised that relevant photo numbers or codes should be recorded on the key drawing/floor plan of each temple (Figure 7).

The expert team also advised that the existing DOANM damage assessment form should be amended to include additional columns for recording risks and immediate security measures needed at the site. The risk assessment helped DOANM to revise its intervention priorities site by site.

It is pertinent to mention here that DOANM had a drone of its own and in the first few days after the earthquake, aerial photos of the damaged temples were collected, which helped to understand the extent of damage to the most significant temples and to identify access routes around various temple sites. However, as at the time of the earthquake, DOANM did not have a system in place that could track all the information gathered and help to analyse and visualise it. Therefore, all the photographs were stored on personal computers separately and had to be manually inserted into the electronic forms. Moreover, DOANM had not developed the required

Figure 8. Interior of a church in Bohol, Philippines damaged as a result of the 2013 earthquake

safety measures for long-term preservation and accessibility of the digital data gathered in different formats.

POST-DISASTER ASSESSMENT IN THE PHILIPPINES AND ITALY

Similar challenges as the ones discussed above were encountered in undertaking the post-disaster assessment for the affected cultural heritage in Philippines in 2013, when an earthquake struck Bohol in central Visayas on October 15. Barely one month later, super typhoon Yolanda devastated the same region and its neighbouring islands. An added complication was the distance between the different affected islands and their inaccessibility in the first few days after the twin disasters. Several grade A churches and their artefacts were damaged (Figure 8). Some museums and libraries were affected as well. Considerable damage to intangible heritage was estimated. However, the lack of a national inventory of intangible heritage prevented a comprehensive survey. Separate teams were sent to assess damage to immovable and movable heritage. In addition, there was no centralised system in place to collate, analyse and visualise the damage to all types of heritage. Thus, developing an accurate cost estimate for damage and losses proved to be challenging.

In the case of the recent earthquakes in central Italy, the Department of Civil Protection was in charge of coordinating emergency response including that for cultural heritage. Due to higher causalities, and the inaccessibility of the affected mountain towns, the search and rescue operations continued for the first ten days after the earthquake. The data-gathering tools were well developed, but the field assessment teams had to be established. As the cost estimates for the next steps were being developed, two more earthquakes struck the same area, but with different epicentres. As a result, once again the damage assessment had to be undertaken. The lesson to be learnt is that, following the first earthquake, the initial damage assessment should have included a thorough risk assessment of the historic structures in the neighbouring areas as aftershocks and other earthquakes are likely to occur if the energy is not fully dissipated.

CONCLUSION

Assessing damage to cultural heritage in the immediate aftermath of a large-scale disaster is complex. Only after removing and sorting through the debris of fallen structures and broken objects can the costs of stabilisation and restoration be estimated. This implies that the process of assessing damage to cultural heritage has to be broken down into two phases: in phase one, an on-site assessment is needed to estimate costs for salvaging, stabilising and mitigating risks to cultural heritage; and in phase two, a detailed condition assessment of the damaged objects and structural elements is needed to estimate the costs of full conservation treatments and rehabilitation.

Such assessments should be integrated to include movable, immovable and intangible heritage elements. In fact, it is counterproductive to hold separate post-disaster damage assessments as valuable time can be lost in unifying all assessments and in developing sector-wide priorities.

Moreover, since the cultural sector is largely informal, estimating losses such as the loss of livelihoods or that of income generated through tourism remains difficult. Conducting damage assessment for intangible culture is equally problematic. To begin with, the knowledge and tools for inventorying intangible heritage are still under development. To overcome these difficulties, national cultural heritage departments as well as ministries of culture need to develop geo-referenced data on cultural heritage assets of all types and also update information on the revenue generated and number of people employed. Providing this information will ensure a timely and accurate estimate of recovery costs through PDNAs.

It is also important that post-disaster damage assessments include site-by-site risk assessments, since it was noted in the case of Myanmar and central Italy that if immediate risks are not mitigated, secondary hazards such as rain or aftershocks can further increase damage and delay recovery.

In conclusion, the success of an at-scale post-disaster damage assessment relies on three factors: trained teams of heritage professionals and volunteers who understand and perceive degrees of damage to a variety of cultural heritage in a similar way and are familiar with the data gathering tools; the ready availability of pre-disaster baseline data for all heritage types complete with geo-locations; and a tested centralised system for emergency data gathering, tracking, analysis and visualisation.

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