

Post-Earthquake Disaster Risk Management of Cultural Heritage: A Case of Patan Durbar Square

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Abstract

Cultural heritages are more prone to disasters due to its age, lack of periodic maintenance and proper management plan. The 7.6 magnitude earthquake of 2015 that struck Nepal followed by numerous aftershocks, had a huge impact not only in the lives of the people but also on the cultural heritages of the country. Many heritages were completely or partially damaged and heritages listed in the World Heritage Site also suffered significant damage. This research provides an overview on the response and the reconstruction activities of the cultural heritages of Patan Durbar Square after the earthquake. Explorative research has been done and concerned stakeholders have been interviewed to identified the issues and challenges which were due to the lack of preparedness plan. Thus, based on the identified issues and challenges Preparedness Plan is proposed for the reconstruction of the damaged heritages.

Keywords

Culture Heritage, Reconstruction, Response, Earthquake, Disaster, Guidelines, Preparedness Plan, Patan Durbar Square

1. Introduction

1.1 Background

Nepal is world renowned for its rich cultural heritages. The ancient monuments of the country date back to 5th century and because of its outstanding universal value two of the cultural heritages of Nepal are listed in the World Heritage List by UNESCO. One of them is Lumbini and the other is Kathmandu Valley which consists of seven monument zones which include Pashupatinath, Changunarayan, Swayambhu, Bauddhanath, Hamuman Dhoka Durbar Square, Patan Durbar Square and Bhaktapur Durbar Square. Nepal was struck by an earthquake of 7.6 magnitudes on 25 of April 2015 causing thousands of human casualties, destruction of buildings, damage of infrastructures and cultural heritages [1].

According to Department of Archaeology (DOA), 104 archaeological sites were partially or fully damaged after the 2015 earthquake. A total of 743 structures were affected by the earthquake out of which 133 structures had collapsed, 95 had partially collapsed and 515 were damaged. Out of these structures 417

belonged to Kathmandu, Bhaktapur and Lalitpur especially those of the three Durbar Squares.

The cultural heritages of Nepal are also linked to the day to day life of the people. It not only reflects our identity but is also an important asset of the country. Disasters not only cause material damage but also put the lives of visitors, staff and local communities in and around cultural heritage properties at risk. Cultural heritages are not only becoming more exposed to disasters but are also at risk from post disaster response and reconstruction phase [2]. Reconstruction is ongoing following different processes but the evaluation of the processes based on preservation of heritage value and the evaluation criteria has not clearly been defined.

1.2 The Study Area

The study area is Patan Durbar Square which is situated in the center of Lalitpur District. It is one of the seven monument zones which was listed in the world heritage list in 1979 under one single entity as Kathmandu Valley World Heritage Site. The Kathmandu Valley was inscribed as the 121st World

Heritage Site based on criteria (iii),(iv) and (vi) for World Heritage sites [3].

According to DOA in Lalitpur District, 130 cultural heritages were destroyed among which 13 were collapsed, 20 were partially collapsed and 87 were partly damaged. Many of these monuments lies in the Durbar Square among them Harishankar Mandir, Char Narayan Mandir were destroyed in the disaster, while Degu Taleju Mandir, Krishna Mandir, Bhimsen Mandir, the palace of Bahadur Shah, Vishveshvara Mandir sustained varied degree of damage.

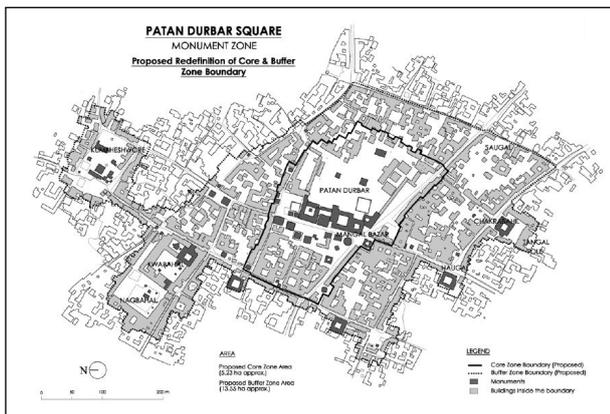


Figure 1: Patan Durbar Square Core and Buffer Zone (UNESCO)

1.3 Objectives

The main objective of this study is to identify the gaps and challenges in the reconstruction of cultural heritages of Patan Durbar Square after the 2015 Earthquake.

Specific Objectives are:

- To study the different damaged and vulnerable heritages and the post earthquake activities in the Patan Durbar Square.
- To study the existing reconstruction management practices.
- To prepare a Preparedness plan for heritage reconstruction after earthquake for Patan Durbar Square.

1.4 Limitations

The cultural heritages of Patan Durbar Square are exposed to a number of natural and human – induced disasters but only seismic hazard is considered for this research. Disaster Risk Management of cultural heritage after the earthquake (Post disaster phase) i.e. the response and reconstruction phases is considered

in this research. The reconstruction of the monuments within the Patan Durbar Square has been emphasized while the restoration of the public and private houses has not been considered in this research.

2. Literature Review

The unique geographic setting and topography of Nepal makes it more exposed to several recurrent hazards. Nepal stands at the top 20th position in the most disaster prone countries in the world and ranks 4th, 11th and 30th in terms of climate change, earthquake and flood risk respectively [4]. The earthquake of 2015 AD not only killed many people and caused a huge economic loss but also destroyed numerous cultural heritages.

Nepal is known in the world for its unique culture and its magnificent cultural heritages. Cultural heritages are important as it connects us to our past and strengthens our cultural identity and shows us where we come from. But cultural heritages are also more prone to disasters due to its age and the lack of periodic maintainance. Thus, to protect the monuments from damage and for proper management different Acts have been formed in Nepal.

Legal Framework for Cultural Heritages in Nepal

The Department of Archaeology (DOA) which was established in the year 1952-53 is the main agency in Nepal which works for the conservation and protection of the cultural heritages and is powered by the Ancient Monuments Preservation Act (1956) [5]. Beside this Act, the legislation and regulation on the basis of which cultural heritages are protected in Nepal are as follows:

- Guthi Sanstha Act 1964
- Pashupati Area Development Trust Act 1987
- Kathmandu Valley Development Authority Act 1988
- Lumbini Area Development Trust Act 1985
- Nepal Tourism Board Act 1997
- Disaster Risk Reduction and Management Act 2017
- Local Government Operation Act, 2017

Management of World Heritage in Kathmandu Valley

The world heritage section of the DOA deals exclusively with the World Heritage Sites. The Integrated Management Framework was developed as per the Operational Guidelines (Operational

Guidelines for 1972 Convention, revised edition 2011) with the primary objective of the Integrated Management of the Seven Monument Zones of the Kathmandu Valley to protect the Outstanding Universal Value of the World Heritage property. It is a document adopted by the State Party that defines the process of implementing the Integrated Management Plan [6].

Each of the seven monumental zones is managed by a particular Local Government, under the Ministry of Local Development. Within the institutional framework of the central and the local government, each Monument Zone has clearly defined “Site Managers”. The Heritage Division of Lalitpur Sub-metropolitan city together with DOA is responsible for the Patan Durbar Square Monument Zone [7].

Guidelines for Monuments The cultural heritages are divided into three categories as per DOA i.e. (i) Heritage Site, (ii) Monument and (iii) Object. After the 2015 earthquake, DOA has categorized cultural heritage as per the nature of the damage into three groups.

- Intervention for Totally Collapsed Monuments
- Intervention for Critically Damaged Monuments
- Intervention for Non- Critically Damaged Monuments

Recovery and Reconstruction of Cultural Heritage

To reconstruction means building of something new that has been damaged or destroyed which is normally the case in a disaster scenario. There has been a lot of argument regarding the word “reconstruction”. In May 1964, International Charter for the Conservation and Restoration of Monuments and Sites, the Venice Charter was adopted which favored conservation and restoration of monuments and sites, and took a strong standing against reconstruction.

In 1983, the Operational Guidelines for the Implementation of the World Heritage Convention took a slightly broader view, stipulating that any reconstruction should be undertaken only if certain requirements were met i.e.: cultural properties should ‘meet the test of authenticity in design, materials, workmanship or setting and should be based on complete and detail documentation [8].

Warsaw Recommendation on Recovery and Reconstruction of Cultural Heritage

The Warsaw Recommendation is a document

containing a set of rules of conduct that should be followed in the process of reconstruction of cities or destroyed monuments. The recommendation was accepted during the ‘International Conference on Reconstruction: The challenges of World Heritage recovery’ which was held in 2018 in Poland which was attended by heritage experts from 30 countries, ICOMOS, ICCROM, UNESCO etc. The Warsaw Recommendation has proposed non- exhaustive set of principles for the recovery and reconstruction of cultural heritages which are; Terminology, Values, Conservation doctrine, Communities, Allowing time for reflection, Resilience, Capacities and sustainability, Memory and Reconciliation, Documentation, Governance, Planning, Education and Awareness.

3. Methodology

This research is done to explore the subject which makes it an exploratory research. An exploratory study has been done on the heritage sites of Patan Durbar Square, where the restoration projects are currently being implemented. The available project documents have been reviewed and the stakeholders involved in the restoration have been interviewed to map the current trend and the ongoing reconstruction activities.

This research is based on both primary and secondary data. The approach of the research is qualitative as the information collected for this research is based on focused interviews with the concerned stakeholders.

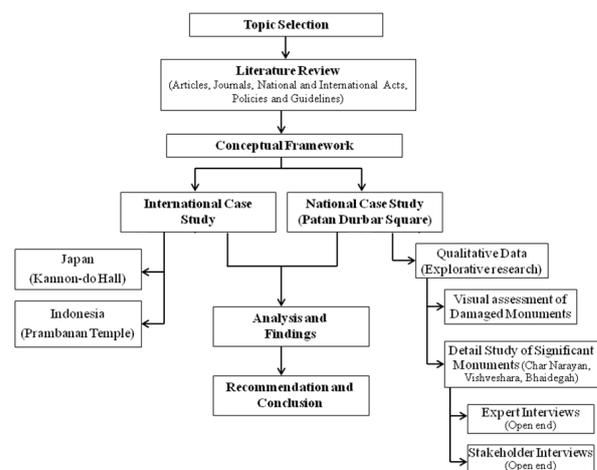


Figure 2: Methodology

The conceptual framework is developed based on the national and international reconstruction guidelines and different parameters have been identified which is

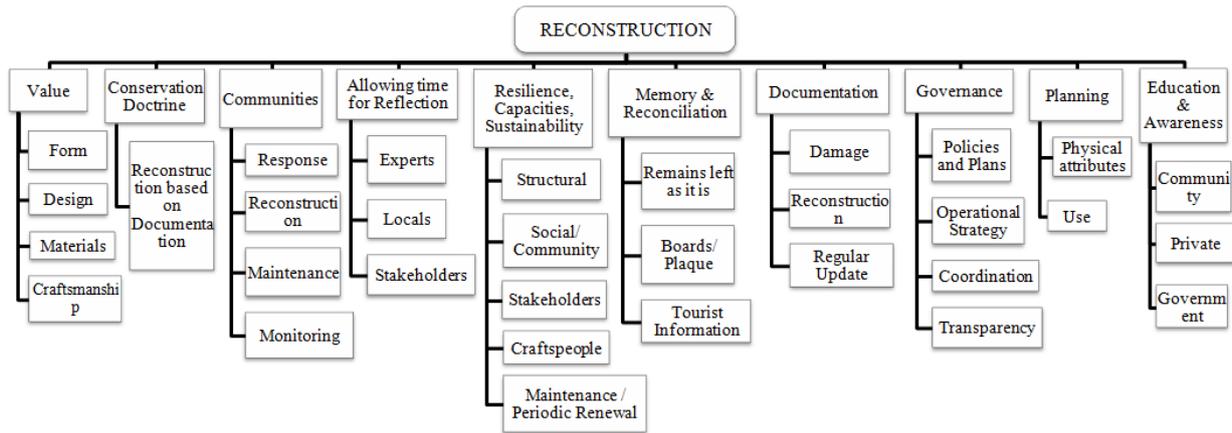


Figure 3: Conceptual Framework of Research

then used to analyze the current reconstruction activities. Finally, gaps and challenges in the reconstruction of heritages in Patan Durbar Square is identified and a Preparedness plan is prepared for earthquake disaster.

4. Case Study

4.1 Restoration of Tenyu-ji Temple Kannon-do Hall, Japan [9]

Tenyi-ji Temple is located in central Ogatsu, founded in the year 1390 had more than 500 parishioner families. Japan was hit by an earthquake on 11th March 2011 followed by the tsunami which destroyed the whole temple complex. Before the earthquake aside from the Kannon-do Hall, there was a complete temple complex including the temple gate, worship hall, priests' quarter, founder's hall, dormitories and bell tower. All these structures were destroyed and Kannon-do hall was also washed away from its foundation, but remained on the temple ground caught by the surrounding trees and is now the only structure standing from the Edo period.



Figure 4: Kannon-do Hall before and after restoration

In Japan, there is a long tradition of historic buildings being once completely or partially dismantled for repairs and then being reassembled again. This was

the method chosen for restoration of Kannon-do Hall.

4.2 Restoration of Prambanan Temple, Indonesia [10]

The Prambanan Temple Compound is the largest temple compound in Indonesia dedicated to Trimurti which was built in the 10th century and lies in the special region of Yogyakarta. With over 500 temples, Prambanan Temple compound represents not only an architectural and cultural treasure, but also a standing proof of past religious peaceful cohabitation. The Temple complex was listed in the UNESCO World Heritage Site in 1991 under (i) and (iv) criteria. (UNESCO)



Figure 5: Prambanan Temple before and after restoration

On May 2006, Yogyakarta and some area of Klaten experienced a very powerful earthquake with magnitude of 5.9 on the Richter scale. The earthquake killed 6000 people and many buildings, roads and historical building suffered severe damage including the Prambanan Temple compound. Almost all of its buildings were damaged by the earthquake, to varying degrees and with various types of destruction. There were two kinds of damage: Structural (Cracking, sloping, rusting, deforming, impacted stability of the building) and Material (Stone falling, breakage and shelling).

4.3 Analysis based on Conceptual Framework

SN.	Principles	JAPAN - Restoration of Kannon-do Hall	INDONESIA - Restoration of Prambanan Temple
1 Value			
Form	Reconstructed in its original form	Restored in its original form	
Design	Reconstructed in its original design	Restored in its original design	
Material	Restored using many of the remaining building members	Fallen stones were properly documented and reattached	
Craftman and Technique	Restored using traditional Japanese joinery techniques and craftsmanship	Skilled craftman were involved in the restoration of the temple	
2 Conservation Doctrine			
Which Conservation	Restoration	Restoration and Consolidation	
Reconstruction based on documentation	Dismantled using numbering system and assembled back together	Lack of technical drawings	
3 Communities			
Response			
Reconstruction	Parishioners were involved in the recovery of the hall	Jogjakarta Heritage Society (JHS) and Yogyakarta Heritage Trust (YHT) were involved	
Monitoring			
Maintenance			
4 Allowing time for reflection			
Experts		National and International Expert from different fields were involved in detail study and investigation of the damage	
Stakeholders			
Locals			
5 Resilience, Capacities and Sustainability			
Structural	Damaged woodworks were		
Technical manpower		Restoration was done by Indonesia experts with assistance from Japanese experts on Geology and Earthquake	
Stakeholders	Cultural Property Fire Drill by the local fire brigade done	Nine capacity building activities on Conservation and Restoration	
Craftspeople	Around 600 skilled workers	Shortage of skilled human resource	
Maintenance/ Periodic Renewal		BP3 Yogyakarta receives fund from Department of culture and Tourism and gets fee from PT Taman Wisata	
6 Memory and Reconciliation			
Remains as it is	Other structure of complex which was washed away is left as it is	15/ 16 temples have been reconstructed and Siwa Temple is	
Information/ Boards/ Plaque	Sign- board was installed on site	Information board is placed on the site	
7 Documentation			
Damage	Damage was properly documented	Damage was properly documented	
Reconstruction documentation	Reconstruction was properly documented with photographs	Documented by documents and pictorial representation	
Decision making			
8 Governance			
Policies and Plans		The Law of the Republic of Indonesia on Heritage; The Regulation of Yogyakarta Province on the Management of Heritage Area	
Operational Strategy	Roof scaffolding was done to protect the hall from wind, rain	Management is done by The archaeological Office of Yogyakarta	
Coordination national & international	Executive Committee of Ishinomaki Cultural Heritage Restoration and Reconstruction (ECICHRR) was the main Project organizer	The Government established immediately a Task Force, responsible for identifying, co-ordinating and implementing actions necessary for the protection	
Transparency	Sign boards were placed	Sign boards were placed	
9 Planning			
Physical attributes		The environmental attributes were considered during the restoration	
Use	Place where locals gathered for new year, Buddha's birthday & Segaki		
10 Eduation and Awareness			
Local people/ Community Groups	Awareness by Panel exhibition, site visit by Furusato Children's College	Awareness by different educational facilities are also such as leaflets, maps, information boards, guides, museum and audio-visual shows	
Private Organization			
Government/ Stakeholders			

5. Data Collection and Analysis

5.1 Post Earthquake scenario in Patan Durbar Square

The earthquake of 2015 had a massive impact on the heritage of Patan Durbar Square. As per data collected from DOA, six monuments were totally collapsed, four monuments were partially damaged and five monuments were structurally weakened. The Char Narayan Temple, Hari Shankar temple and Manimandap were totally destroyed leaving only their plinths while Visveshvara Mandir and Bhimsen Mandir were partially damaged.

Another important monument Krishna Temple was partially damaged and maximum damage was seen on the second floor. The roof of the north and south Taleju was also damaged. The earthquake also caused a total collapse of the upper two storey of the east wing's rear façade and the central portion of the first and second storey of the quadrangle's facade.

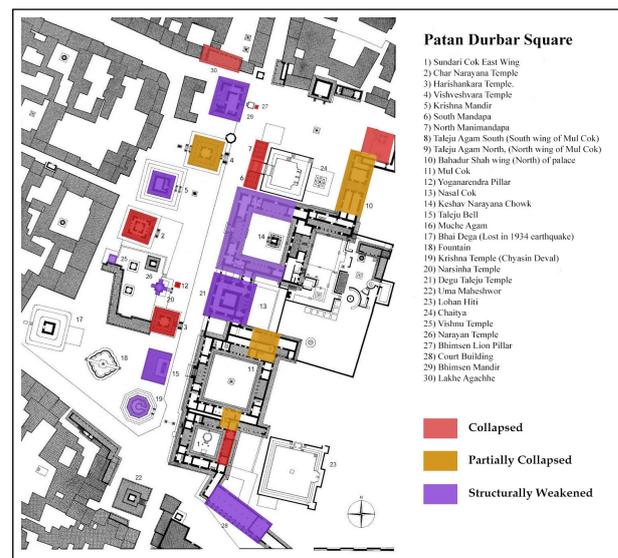


Figure 6: Damaged and Collapsed Monument in Patan Durbar Square

5.2 Response after the Earthquake

The Department of Archaeology (DOA) mobilized its staff in different areas to collect the preliminary data about damaged heritages. A format was developed for the preliminary assessment and two teams were formed; Rescue team for the data collection and Expert team for the vulnerability assessment of heritages. In Patan Durbar Square immediately after the earthquake Nepalese army, Police and volunteers came for the rescue operations. Excavators were brought to the

site to clear the debris which was instantly stopped by KVPT to protect the further damage of elements of the monuments. The debris was then removed by hand because of which many elements of the monument could be properly recovered.

Together with Nepali police, locals, volunteers, KVPT, municipality, Patan Museum and Department of Archaeology started collecting the parts of the damaged or destroyed monuments and storing them in safe place. Sorting of the salvage materials, assessing the damaged monuments, shoring up unstable structures and established a workshop in the palace garden to store, study and repair pieces was done. The recovered building elements were then cleaned, repaired and/or replicated where necessary and then stored until used for restoration.

5.3 Repair and Reconstruction Phase

The Kathmandu Valley Preservation Trust (KVPT) in close collaboration with Department of Archaeology (DOA) started the reconstruction of most of the monuments in the Patan Durbar Square. The drawings and documentation of the monuments were not available which had to be prepared. For the reconstruction drawings were prepared by KVPT which was then presented in DOA for approval after which restoration began. Steering committee was formed before the earthquake for better coordination and decision making and it consists of members from DOA, Tole Sudhar, Museum, Local Police, Nagarpalika, Ward Chairman, KVPT and other concerned stakeholders.

Till today nine damaged monuments in the Durbar Square has already been restored and they are Manimandap, Vishveshvara Temple, Patan Palace Taleju North and South, Krishna Mandir etc. while Charnarayan Temple, Bhimsen Temple, North wing of Keshav Narayan Chowk and Harishakar Temples are being restored.

5.4 Detail study of Significant Monuments

Char Narayan Temple (Totally Collapsed Monument) Char Narayan also called the Jagannarayan, is the oldest temple in Patan Durbar Square and was built by a local ruler, Purandarasingha in 1565. The square based temple is primarily made up of brick and was constructed in the classical Newar tradition with two pyramidal roofs and an inner ambulatory. The earthquake of 2015 had collapsed the

Malla era multi-tiered temple down to its plinth. Almost all architectural fragments were salvaged and stored with the help of the army and police at the neighboring Keshav Narayan Chowk of the palace.

Vishveshvara Temple (Critically Damaged Monument) The Vishveshvara Temple was established by King Siddhinarasimha Malla in 1627 and installed a linga and dedicated it to the Lord of All, Vishveshvara or Visvanath. The temple is a two-tiered temple and introduced an outer ambulatory encircling the sanctum consisting of 20 pillars. The earthquake of 2015 had caused substantial damage to the temple mainly on the ground floor level.

Bhaidegah Temple Bhaidegan Temple was built by the Patan Kingdom's Chautaria (Prime Minister) Bharo Bhagirath Bhaiya in 1678. The temple was constructed as a three-tiered pagoda temple and was dedicated to Vishveshvara. The temple was destroyed in the 1934 earthquake up to the plinth level and was never reconstructed in its original form, instead a Moghul-style dome was built on top of the existing plinth to protect the Shiva lingam. A group of citizens 'Sanskritik Sampada Samrakshan Samuha,' came together in 2011 to restore the Bhaidegah temple to its original form.

5.5 Analysis based on Conceptual Framework

SN.	Principles	Observation of Ongoing Reconstruction			Inference
		Char Narayan	Vishveshvara	Bhaidegah	
1 Value					
	Form	Restored in its original form		Reconstruction to original form of 1678	Monuments was restored with respect to the value for which it was inscribed in the World Heritage List.
	Design	Restored in its original design			
	Material	Traditional materials used as per specification by DOA; difficult in availability			
	Craftsman and Technique	Around 45 workers currently working. Lack of artisans and craftsman experienced in heritage buildings			
2 Conservation Doctrine					
	Which Conservation Doctrine followed	Restoration		Reconstruction	Doctrine followed as per the damage of the monument
	Reconstruction based on documentation	Drawings by Wolfgang Korn; photos by Stanislaw Klimek and Jaroslav Poncar	Drawings by Bijay Basukala, 2008	Photos by Felix Brandt; water color Henry Ambrose; struts, pillars from Patan Museum store	Drawings & and documentation prepared only after Earthquake
3 Communities					
	Response	Yes, Mangal Tole Sudhar Sangh.			Lack of direct involvement may affect the capacity of community in reconstruction in case of future disaster
	Reconstruction	Not directly involved in reconstruction process			
	Maintenance	No provision for repair and maintenance			
	Monitoring	Yes, timely by the Mangal Tole Sudhar Sangh and 1 person from the samitte is also involved with KVPT			

SN.	Principles	Observation of Ongoing Reconstruction		Inference	
		Char Narayan	Vishveshvara Bhaidegah		
4 Allowing time for reflection					
	Experts	Experts opinion was taken wherever necessary		Helped in proper restoration & gives community a sense of ownership	
	Stakeholders	Drawings presented in DOA in presence of the steering committee and necessary feedbacks taken			
	Locals	Communities opinion was also considered			
5 Resilience, Capacities and Sustainability					
	Structural	Steel connection; Nut bolts used, wooden columns added inside walls, DPC	Infill south lower plinth with Ma-apa in mud mortar, steel dowel used between added new and old wood column	Infill between second and third plinth replaced by Ma-apa in mud mortar	Failure during the earthquake was studied & necessary strengthening was done. Done only after consultation with the experts
	Technical manpower	Lack of technical manpower experienced in historic buildings and code for assessment		It shows the lack of training or skill development activities	
	Stakeholders	Stakeholders trained to some amount on earthquake response, heritage conservation, scientific documentation by DOA, UNESCO, ICCROM, etc.		Training related to DRM & reconstruction missing	
	Craftspeople	Four times a year 15 days training given to craftsman by DOA. Some training given by KVPT. No training given to new artisans.		Has helped in understanding traditional techniques & in restoration	
	Maintenance / Periodic Renewal	There is provision of 'DOA Emergency Fund' and 'Woda Marmat Sambhar Kosh' but the fund is very minimum. No provision for maintenance of this particular heritage site		May result in the increase of vulnerability of the monument to other hazards	
6 Memory and Reconciliation					
	Remains as it is	Missing parts replaced with replicas. In case of no documentation left plain		Replica is distinguished from the originals	
	Information/ Boards/ Plaque	Information board & Photo Slide Presentation is placed. Information regarding history and earthquake damage is missing		Necessary to aware people about imp. of heritage & earthquake damage	
7 Documentation					
	Damage	The damage after the earthquake was documented by DOA and KVPT		Will help in the maintenance/ renewal in the future and will also aid in restoration in case of another disaster	
	Reconstruction documentation	Reconstruction is also being documented on daily basis through photos, videos of every part and also through measurement and drawings			
	Decision making process	Is also documented through minutes of every meetings by DOA			
8 Governance					
	Policies and Plans	Guideline and Manual developed after earthquake followed		Lack of operational strategy caused delay in response and reconstruction	
	Operational Strategy	Planning for disaster response and reconstruction is missing. Safe storage area, assessment form were not defined			
	Coordination national & international	Meeting of Steering Committee is conducted in every 2 months		Good coordination and transparency has helped in the proper restoration	
	Transparency	Difficult in availability of the fund. Auditing is done every year			
9 Planning					
	Physical attributes	No		This will ensure the continuous use and sustainability of the monument	
	Use	Yes, the use of the monument is considered before its reconstruction			
10 Education and Awareness					
	Local people/ Private Organization / Government	Lack of education and awareness program in the community about importance and value of heritages (plain wood pieces were burned, long woods were taken to support personal houses by the locals). Students awareness program is being conducted by KVPT.		May lead to theft and vandalism in the time of another disaster	

6. Findings

The lack of emergency response plan led to delay in the response activities because of which many elements of the monuments were either damaged or stolen. KVPT has taken the responsibility for the reconstruction of most of the monuments in the Patan Durbar Square and within four years they have successfully restored nine monuments. But the lack of availability of fund, material and skilled manpower has caused problems in the restoration of the other damaged monuments.

The decision for the reconstruction is made through the Steering Committee. A good coordination is seen between the DOA, municipality, ward, local police, Tole sudhar and the concerned stakeholders in the reconstruction process. The community is also well involved in the monitoring of the reconstruction activities.

6.1 Gaps and Challenges in Response and Reconstruction

It's already been four years after the earthquake and many monuments still need to be restored. The gaps and challenges during the response and the reconstruction of the monuments in the Patan Durbar Square are as follows:

- Difficulty in the availability of traditional materials, funds and craftsman experienced in heritage restoration.
- Lack of training to the new artisans on restoration of heritage buildings.
- Lack of prepared drawings and documentation before the earthquake.
- Involvement of community in response and monitoring but lacking in reconstruction process
- Lack of education and awareness programs in the community.
- Lack of technical manpower and codes for the assessment of the historic monuments.
- Stakeholders trained but lack in case of new staffs on disaster management and reconstruction of heritages
- No provision of maintenance or periodic renewal of the monuments.
- Lack of emergency response and rehabilitation, operational strategies, plans and policies in different levels of development activities.

7. Conclusion and Recommendation

7.1 Conclusion

The restoration or reconstruction of the monuments needs to be done properly so that the belief and the value for which it is considered important remain unchanged. The reconstruction of the monument of Patan Durbar Square has followed the reconstruction guidelines to some extent. However, there are certain gaps and challenges which need to be addressed timely.

Thus, preparedness plan should be developed before disaster which will help in addressing the identified gaps and challenges and needs to be developed in other cultural heritages as well.

7.2 Recommendation

The different issues and challenges in response and reconstruction in Patan Durbar Square were identified which were due to the lack of preparedness plan. Preparedness plan is very important for the proper response and reconstruction of the heritages in order to protect it from different disasters and conserve the value for which it is protected. Preparedness plan is the measure taken to prepare for and reduce the effects of disaster and it provides a platform to take important steps to minimize the threat of damage.

Thus, based on the issues and challenges identified the following recommendations are proposed for proper response and reconstruction/ restoration of cultural heritages in Patan Durbar Square.

- Preparation of Operational Strategy for Heritage Reconstruction
- Prepare Format for Heritage Impact Assessment and Training
- Storage area identification for Salvaged Materials
- Coordination
- Documentation
- Provision for Repair and Maintenance
- Coordination with other agencies
- Training
- Education and Awareness

Therefore, on the basis of the identified issues and challenges a Preparedness Plan is developed for reconstruction of heritages for Earthquake disaster.

SN.	Activity	Implementing Agency	Cooperating Agency	Time	Estimated Cost	Remarks
1	Preparation of Operational strategy for Heritage Reconstruction/ Restoration	DOA	Mun./ Ward, Community	Imm.		
2	Prepare Format for Heritage Impact Assessment & training should be given	DOA	Mun./ Ward, Community	Imm.		
3	Space allocation for collection, storage cleaning and repair of salvage materials	Mun.	DOA/ Ward, Community	1 month		
4	Defining coordination mechanism among experts, stakeholders and community	DOA	Ward, Community, I/NGO	1 month		
5	Preparation of Drawings and estimates which should be easily accessible	Mun.	DOA/ Ward, Community	1 year		
6	Provision of repair, maintenance or periodic renewal	Mun.	Ward, Community, I/NGO	Imm.		
7	Coordinate with other agencies for supply of traditional materials	Mun.	DOA/ Ward, Community	Imm.		
8	Prepare an inventory of skilled craftsman and workers	Mun.	Ward, Community, I/NGO	1 month		
9	Training of technical manpower in heritage building restoration	Mun.	DOA/ Ward, I/NGO, Private	1 year		
10	Training of new and old craftsman, artisans and masons	Mun.	DOA/ Ward, I/NGO	1 year		
11	Education to the community about importance and value of heritage	Mun.	DOA/ Ward, Locals, I/NGO	Imm.		
12	Raise awareness about earthquake risk and its impact in heritages	Mun.	DOA/ Ward, Locals, I/NGO	Imm.		

References

- [1] Government of Nepal and National Seismological Center. <http://seismonepal.gov.np/earthquakes>, accessed: February 2019.
- [2] Rohit Jigyasu. Towards developing methodology for integrated risk management of cultural heritage sites and their settings. 2005.
- [3] UNESCO (Kathmandu Valley World Heritage Site). <https://whc.unesco.org/en/statesparties/np>, accessed: February 2019.
- [4] MOHA. Disaster risk reduction in nepal: Achievements, challenges and ways forward; 2016.
- [5] Neel Kamal Chapagain. Heritage conservation in nepal: policies, stakeholders and challenges. 2008.
- [6] Government of Nepal and Department of Archaeology. Kathmandu valley world heritage site integrated management framework, 2007.
- [7] Government of Nepal and Department of Archaeology. Kathmandu valley world heritage site: Management handbook for patan durbar square monument zone, 2007.
- [8] Jukka Jokilehto. Reconstruction in the world heritage context.
- [9] WMF. A report on the restoration of tenyu-ji temple kannon -do hall after the great east japan earthquake; 2014.
- [10] Gadjah Mada University and International Recovery Platform. The recovery status report: The yogyakarta and central java earthquake 2006; 2009.