

NEPAL EARTHQUAKE 2015: LESSONS LEARNT AND WAY FORWARD

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Keywords

Earthquake, Proactive, Impact, Management, Legislation, deficiencies

Abstract

Nepal is prone to various types of disasters such as: earthquakes, floods, landslides, fires, epidemics, avalanches, windstorms, hailstorms, lightning, glacier lake outburst floods, droughts and extreme weather events. Among all these disasters – earthquake is the most scary and damaging. The effects of a disaster, whether natural or human induced, are often far reaching. In addition to the natural factors, the losses from disasters are increasing due to the human activities and absence of proactive legislations. Fundamentally, the weak structures have been found as the major cause of infrastructure collapse in earthquakes. This emphasizes the need for strict compliance of town planning bye-laws and earthquake resistant building codes. Thus, proactive disaster management legislation focusing on disaster preparedness is necessary. This paper analyses the critical gaps responsible for emphasizing the seismic risk and of factors that would contribute towards seismic risk reduction to enable various stakeholders to address the critical areas for improving seismic safety in Nepal and other earthquake prone countries. Additionally, this paper aims to pinpoint the deficiencies in disaster management system in Nepal with reference to the devastating earthquake of 25 April 2015 and suggest appropriate policy and advanced technical measures.

1. Background

An earthquake disaster is the most terrifying disaster in Nepal but Nepal is not limited to just earthquakes; there are also disasters such as floods, landslides, fires, avalanches, windstorms, hailstorms, lightning, glacier lake outburst floods, epidemics, droughts and so on. There have been many occurrences of earthquake disasters in Nepal that have caused heavy casualty losses and physical property damages, adversely affecting the overall development of the country. Nepal's proximity to earthquake hazards is mainly due to her young and fragile geology. Haphazard and unplanned settlements and poor construction practice are the other reasons that have made her highly vulnerable to earthquake impacts. Nepal may have encountered many earthquakes throughout history; it has the record for the greatest loss of life dating back to the 12th century. Since then Nepal has encountered 16 major earthquakes, including the recent devastating earthquake of 25 April 2015.

2. The Devastating Earthquake of 25 April

A 7.8 magnitude earthquake struck Nepal on 25 April 2015 (11:56am local time). It occurred in a geological collision zone, where the Indian tectonic plate pushes north into the Eurasian plate, moving the ground an average of 2cm a year. The epicenter was in Barpak Village of

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Gorkha district which is 81 km northwest from Kathmandu (the capital city). The devastating earthquake killed nearly 9,000 people, injured over 22,000 and rendered millions homeless. More than one hundred thousand households in the urban and sub-urban areas of Bhaktapur and Lalitpur were either totally destroyed or severely damaged, and their inhabitants have been displaced. The situation in rural areas was much worse. The damage was worst in the districts of Gorkha, Dolkha, Sindupalchiok, and Dhading, where many households live in poverty in extremely remote, rural, secluded and hilly villages. In general it was the oldest and most poorly built houses which were most likely to collapse, which were typically inhabited by the poorest, more vulnerable households. The earthquake was followed by a number of aftershocks throughout Nepal, with one shock reaching a magnitude of 6.7 on 26 April at 12:54 am local time. In addition to a number of human casualties, Centuries-old buildings were destroyed at more than five different UNESCO World Heritage sites in the Kathmandu valley. This earthquake was the largest to hit Nepal since the 1988 Nepal earthquake and the Nepal–Bihar earthquake of 1934. All these major earthquakes established that the casualties were caused mainly due to the collapse of infrastructures. Before that Saturday in April 25, 2015, seismologists had been warning of another Big One for years. However, it was shallow, causing violent shaking on the surface. Fortunately, this one was smaller than anticipated. This earthquake also affected some parts of India, Bangladesh, and the Tibet Autonomous Region of China. Tremors were also felt in Bhutan and Pakistan.

On 26 April 2015, the Government of Nepal declared an emergency in the worst affected districts and requested for international humanitarian support.



Picture 2: Damaged Kathmandu Durbar Square which is a Cultural Heritage

On 12 May 2015 at 12:50 local time another strong earthquake measuring 7.3 magnitude struck with the epicenter in Sunkhani of Dolkha district. The epicenter was 76 km northeast of Kathmandu. This area was already affected by the 25 April quake. The initial quake was followed by several aftershocks including a 5.6 magnitude. This quake toppled already weakened buildings, triggered a series of landslides, which further hampered relief efforts. This quake alone killed more than 100 people. The casualty was extraordinarily low given the extent of the damage, due to the time of day of the quake.



According to the Department of Survey of the Government of Nepal, the movement of tectonic plates that triggered massive earthquake in the country on April 25 caused the altitude of Kathmandu Valley to increase by 80 centimeters. In total 376 numbers of aftershocks with Local magnitude ≥ 4 have been recorded till 13 August 2015.



Picture 2: Dharahara (the view tower)—before the earthquake (left) & after the earthquake (right)



Picture3: Avalanche in Mt. Everest where dozens of people died

3. Particulars of the Earthquake

Details of the earthquake are given below in Figure 1.

Figure 1



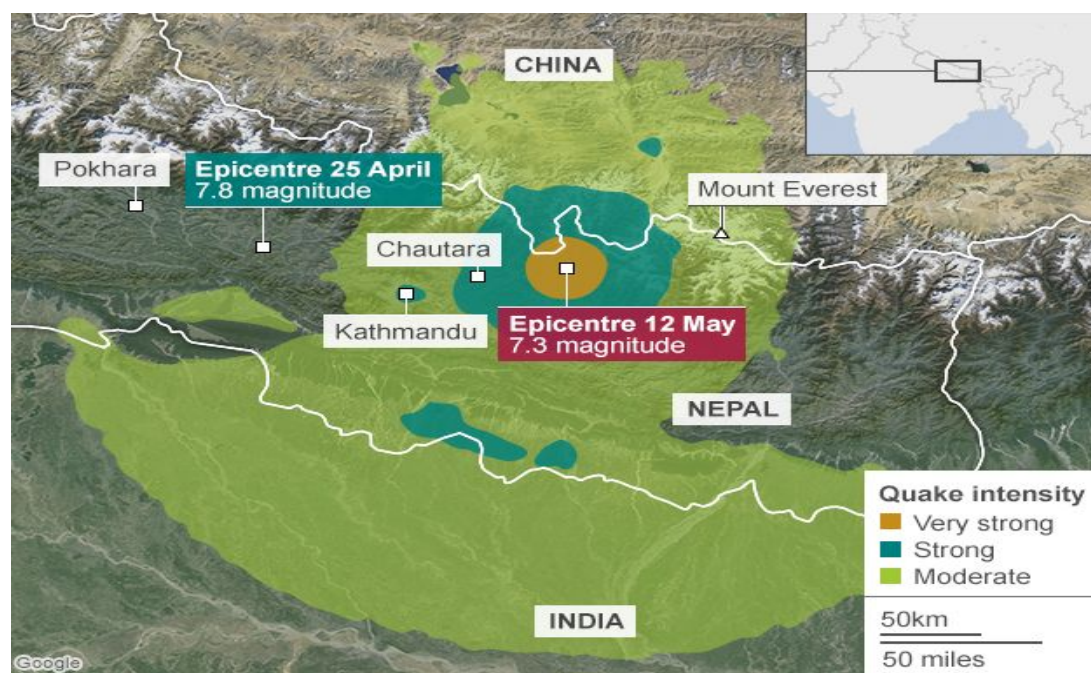
Depth	15.0 km (9.3 mi) ^[1]
Epicenter	28.147°N 84.708°E <u>Coordinates</u> : 28.147°N 84.708°E ^[1]
Type	<u>Thrust</u> ^[1]
Areas affected	<u>Nepal</u> , <u>India</u> , <u>China</u> , <u>Bangladesh</u>
Total damage	≈\$5 billion (about 25% of <u>GDP</u>) ^[3]
Max. intensity	<u>IX (Violent)</u> ^[1]
Aftershocks	<u>7.3M_w on 12 May at 12:51</u> ^[4] 6.7M _w on 26 April at 12:54 ^[5] No. of aftershocks(>=4ML)=365 (as of 31 July 2015) ^[6]
Casualties	8,844 dead in Nepal (officially) and 9,017 in total ^{[7][8]} 22,307 injured (officially) ^[7]

Source: (1) United States Geological Survey. 25 April 2015. Retrieved 12 May 2015 (2) China Earthquake Networks Center. 25 April 2015. Retrieved 28 April 2015 (3) economist.com (4) "M6.6 - 49km E of Lamjung, Nepal"(5) usgs.gov. (6) National Seismological Centre, Nepal(7) Nepal Disaster Risk Reduction Portal. drrportal.gov.np. Retrieved 28 May 2015 (8) The Times of India. 7 May 2015. Retrieved 9 May 2015.

The 2015 Gorkha earthquake affected 31 districts out of which 14 districts namely; Gorkha, Sindhupalchowk, Dhading, Kavre, Dolakha, Nuwakot, Ramechhap, Sindhuli, Rasuwa, Kathmandu, Lalitpur, Bhaktapur, Makwanpur and Okhaldhunga were hard hit.

Please see Figure 2 below for the ramification of the 12 May 2015 earthquake:

Figure 2



Source: USGS

Until now, this devastating earthquake caused 8,844 deaths and 22,307 injuries, flattened hundreds of thousands of homes, and disrupted community lives.

Please see Table 3 below for detail data.

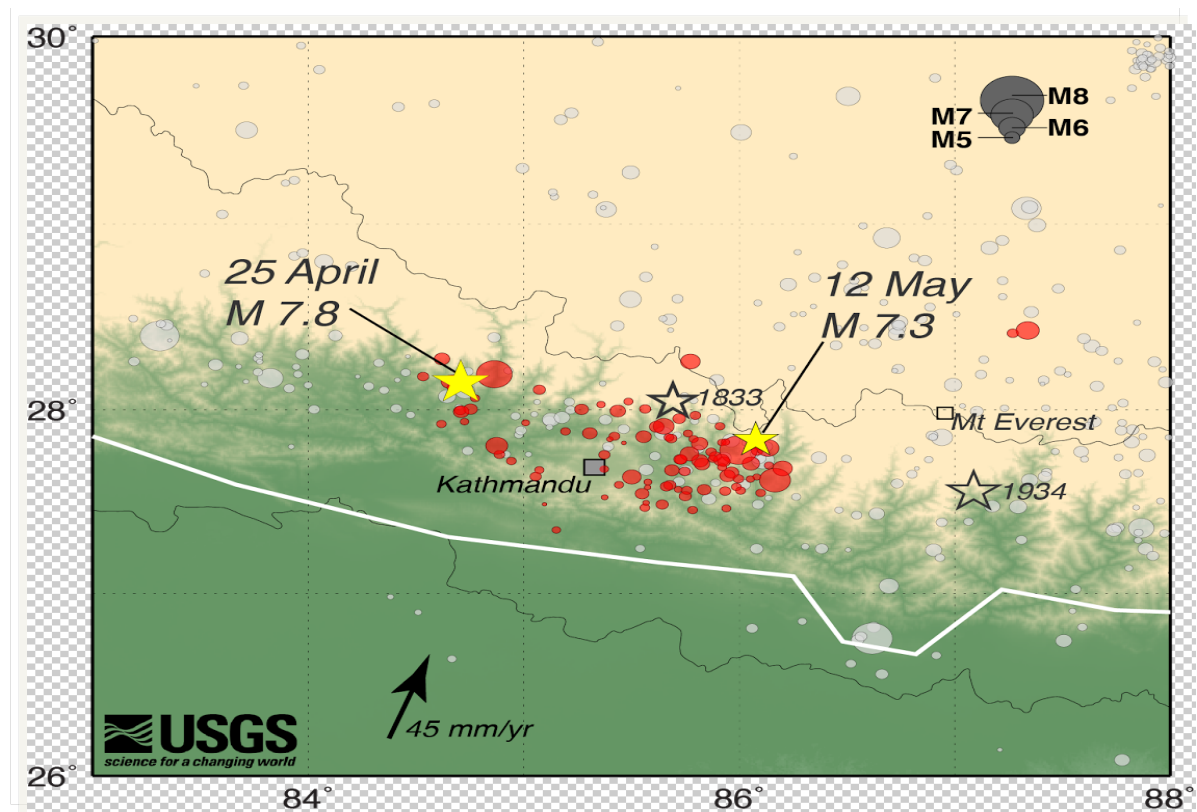
Table 3

Losses due to the Earthquake (As of 27 May 2015)

Particulars	Nos.
Persons dead	8,844
Missing	755
Injured	22,307
Affected Families	11,24,358
Displaced Families	6,51,675
Houses Damaged (Fully)	5,98,401
Houses Damaged (Partially)	2,83,553

Source: Ministry of Home Affairs, the Government of Nepal

4. Causes, Consequences and Scale of the Earthquake



Source: USGS

This earthquake occurred in a geological collision zone, where the Indian tectonic plate pushes north into the Eurasian plate, moving the ground an average of 2cm a year. Over decades, stress built up along a stretch of the fault line, which is called the Main Himalayan Thrust (MHT) fault, close to Nepal's capital Kathmandu. In this area, the boundary between the two plates had become locked - stuck together by friction and so immobile - building up

energy that only a major earthquake could release. Prof Jean-Philippe Avouac, University of Cambridge believes that the quake on 25 April only released part of this pent-up pressure. "If the earthquake had ruptured all the locked zone all the way to the front of the Himalayas, it would have been a much larger earthquake," says Prof Avouac. Some other researchers believe that some of this stress has shifted west, to an area stretching from the west of Pokhara in Nepal to the north of Delhi in India. A major earthquake there is already long overdue: the last happened in 1505 and is estimated to have exceeded M8.5. The researchers say the new stress that has moved there could already be adding to the tension that has been building up over five centuries. "At the moment, we are quite worried about western Nepal," said Prof Avouac.

New data has revealed that the devastating quake that hit Nepal in April did not release all of the stress that had built up underground, and has pushed some of it westwards. The research is published in the journals Nature Geoscience and Science. Its authors say more monitoring is now needed in this area. Prof Jean-Philippe Avouac, from the University of Cambridge, told BBC News: "This is a place that needs attention, and if we had an earthquake today, it would be a disaster because of the density of population not just in western Nepal but also in northern India, in the Gangetic plain." "We don't want to scare people, but it is important they are aware that they are living in a place where there is a lot of energy available," Prof Avouac clarified.

Commenting on the research, Prof David Rothery from Open University said: "Monitoring techniques have now advanced to the stage where we can work out how a previously 'locked' fault has 'unzipped' during the couple of minutes that it takes a major earthquake to happen. "Lives would be saved by drilling school children in western Nepal and the nearby plains of northern India in how to react in the event of an earthquake, and in ensuring that at least school buildings are adequately constructed to survive seismic shaking."

5. Response

Immediately after the earthquake, although there was chaos, confusion and distress -- National Emergency Operation Centre (NEOC) of the Ministry of Home Affairs was activated at level-IV by following the National Disaster Response Framework-2014 and Standard Operating Procedure (SoP). Soon after the quake the Prime Minister, Home Minister, other Ministers, Chief Secretary, Secretaries, high level officials and the security forces were present at the NEOC. Central Command Post was established and Security forces were mobilized immediately for Search and Rescue (SAR) operation with heavy equipment and helicopters. Altogether 66,069 Nepal Army personnel, 41,776 Nepal Police, 24,775 Armed Police Force and 22,500 Civil Servants were mobilized for response. Helicopters were used in remote areas for SAR operation from Nepal Army, India, China, U.S.A. and private sector. In total 7,606 people were rescued by 4,299 flights of Nepal Army, foreign and private sector helicopters. A total of 4,689 people were rescued by land route. Helicopters were mobilized in the command of Chief District Officers (CDO) of Sindhupalchok, Dolakha, Dhading, Nuwakot, Rasuwa and Gorkha districts.

A significant number of volunteer groups and amateur aid workers also provided some assistance. There has also been a considerable amount of aid distributed by various social organizations and also individuals who have collected cash and kind on their own initiative. This includes skilled technical personnel such as doctors, nurses, and engineers as well as unskilled personnel making in-kind distributions. The overall biggest amount of recovery assistance came from cash directly to households from remittances as well.

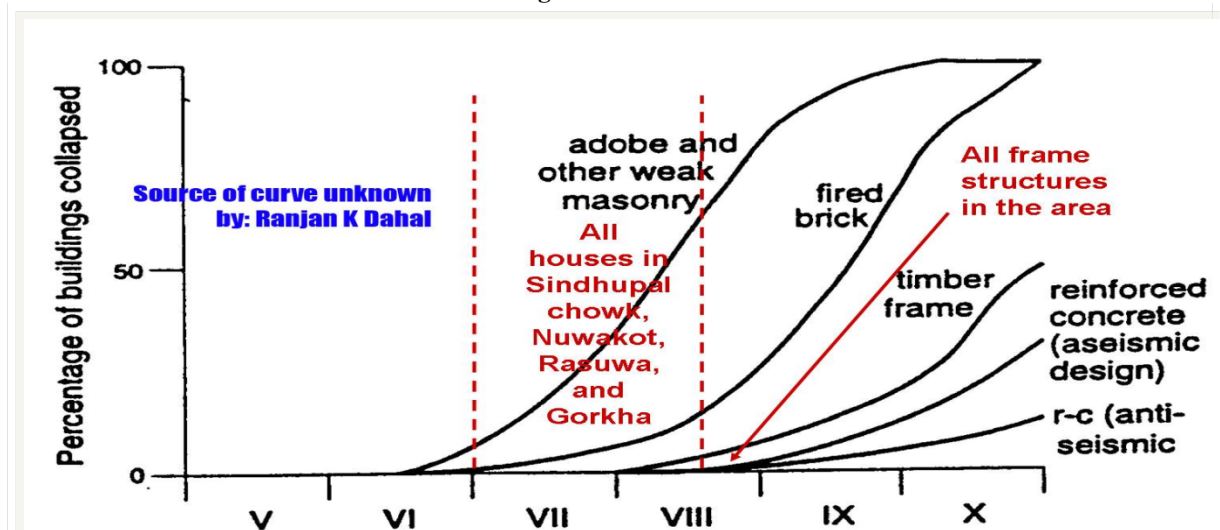
Although the Nepalese government and security forces - particularly the military - played a significant role in response works, there was serious lack of capacity and resources.

6. Damage Pattern

Mostly, old infrastructures were collapsed and/or severely damaged by the earthquake. Some buildings which seemed quite stable were also damaged because of the poor quality of construction materials, and poor construction supervision. In the sub-urban areas of Kathmandu valley, houses are built with bricks or mud. Outside the Kathmandu valley, particularly in rural areas, the houses are built of mud and mortar with thatch or brick roofing, which easily collapsed in the earthquake. In Tarai and in poorer villages also houses are built with bricks or mud. In the hilly region, stones and mud walls are very common. Poor people use bamboo-reinforced mud walls. The western area is mainly farmland, and the poorer communities live in mud and straw huts, a number of which disintegrate and crumble in the event of flooding.

During the 2015 earthquakes, it was primarily the older buildings which collapsed completely, many of them built with clay bricks or stone, and lacking sufficient vertical and horizontal beams. These dwellings are also most likely to have been inhabited by the poor. Reinforced concrete homes sustained much better, though in the areas closest to the epicenter many of these also collapsed or cracked beyond repair. The damage pattern of the earthquake is as following:

Figure 1



A preliminary estimate indicates that more than 80% of homes in the 14 most affected districts were severely damaged, creating huge mounds of rubble and debris impeding life-saving operations and access to affected areas. More than 25 hospitals and more than 900 smaller facilities, predominantly village health posts which supply basic medicines and other routine services in remote communities outside the Kathmandu valley, were completely or partially damaged in the earthquake. Since the 25 April disaster, nearly 2 million people have been displaced because their homes have been destroyed or the fear that their homes may not be safe enough to reside in. Many are still living in open fields in tents.

Data collected from advanced GPS stations have revealed that the death toll could have been far higher. These stations track tiny shifts in ground position, at a rate of five measurements every second. The seismic waves travelling underground were a lower frequency than expected, causing the ground to vibrate more gently. Prof Jean-Philippe Avouac, University of Cambridge says that "this earthquake didn't generate a lot of high frequency waves, which would have been devastating for the small buildings in Kathmandu. They could withstand the earthquake because of the characteristics of the 'pulse' - and its relative smoothness."

The Post-Disaster Needs Assessment (PDNA) carried out by the government estimates that \$6.7 billion will be needed for reconstruction and rehabilitation. The government has already set up a National Reconstruction Fund of \$2 billion for post-earthquake reconstruction and rehabilitation works.

7. Problems Associated with the Great Earthquake

The response work was highly criticized as it was not prompt and well organized. A key complaint was of a slow and inadequate relief effort, which failed to reach in due time to many of the affected people of remote, rural and hilly areas. It was mainly due to the lack of a strong road network and transport resources, especially helicopters, and a serious bottleneck at the airport. Major delays were also caused by bureaucratic procedures and even bitter mutual accusations - both in public and private—over who was to blame and who should be in control of resources.

Thousands of people in the affected districts still lack even the most rudimentary shelters and even those who have received tarps are suffering. The monsoon season has begun and the affected people are in a difficult situation. Tarps and tents will not be able to withstand the monsoon downpour. While local governments have been working day and night to provide relief supplies to people in the affected districts, they have found it very difficult to procure adequate supplies from the center.

Now, the monsoon has already started which will not only expose households living in temporary or transitional shelter to extreme weather, cold and increased diseases, but also to further collapses of houses damaged during the earthquake. Every year several dozen houses will collapse due to landslides and floods in heavy rains, and this year the situation is much worse as the earthquake has triggered the mountains causing numerous cracks. Landslides and rains will aggravate the condition of roads, adding to the logistical challenges.

8. International Cooperation and Disputes

On 26 April 2015, the Government of Nepal declared an emergency in the worst affected districts and made a request for international humanitarian support. For any government, it would be difficult to cope alone with such a huge disaster. Therefore, international assistance is pertinent for response and rehabilitation efforts for victims and the rebuilding of structures. It is more difficult in Nepal due to some of its inaccessible landscape and difficult terrain. Unfortunately, it risks adding a man-made calamity to a devastating natural disaster. During the course of search and rescue efforts, an American helicopter crashed near the Nepal-China border resulting in the sad demise of five American soldiers, two Nepali soldiers and five disaster victims.

Actually, relations between the Nepal government and the international community were not conducive for some time right after the earthquake. However, it did improve as time passed. There was the problem of mutual trust. Actually, the donor communities didn't fully trust the government; questioning its ability to deliver services while the government wasn't happy because the donor communities wanted to spend the assistance money through their agents. On the other hand the Nepalese government wants any assistance to be collected into the Prime Minister Relief Aid Fund and then channel to the affected areas. In other words, the government wants to adopt one door policy.

Earthquake victims have repeatedly complained that the rice distributed in relief was "substandard and inedible". The rice was distributed in various districts by the World Food Program (WFP) through Nepal Red Cross Society (NRCS).

9. Set Back to the Development Process

This mega disaster will have a long-term effect on Nepal's economy and development efforts for several years. The agriculture, industry, tourism and service sectors have been badly affected. This is a major set-back. It will take many years to revive. If the government will be efficient, effective and honest then the recovery will be fast. If not, it will take a long time and will pass through the similar situation as Haiti has faced since its own earthquake in 2010. This is high time for Nepal to learn a lesson from Haiti while Nepal must not repeat the mistakes done by the Haitian government after the 10 January 2010 earthquake.

10. Generous Aid Pledges Delight Nepal

There was a donor community meeting on 25 June 2015 in Kathmandu, Nepal. The highest-profile international donor conference ever held in the country amassed more than 300 delegates from 56 nations, development partners and the donor community. In a major boost to Nepal's reconstruction and recovery efforts, development partners and the donor community have pledged \$4.4 billion in aid during the International Conference on Nepal's Reconstruction (2015). This has come as a huge relief to the reconstruction and recovery bid and brought cheers to the government. As a matter of fact, this amount has been beyond the expectation of the government.

11. Formation of Reconstruction Authority Through An Ordinance

An Ordinance on 'Reconstruction of the Structures Damaged by Earthquake -2015' has been promulgated to carry out post-earthquake reconstruction works. According to the ordinance, an 11-member Reconstruction Authority would be formed under the chairmanship of Prime Minister, including four ministers picked by PM, a chief executive officer, Vice-chairperson of the National Planning Commission, Chief Secretary and three experts having 15 years of experience in related field after completing post-graduate degree in infrastructure engineering, law, economics, management, economic or social development as members. The tenure of the authority will be five years and the government can either extend its term by a year if the tasks of reconstruction remained incomplete or assign any other body for the same. The CEO can recommend chairman to appoint secretary of the authority from among government officers. Laws related to acquiring and registering land, public procurement and Environment Impact Assessment will not be applicable in the quake-hit areas to accomplish the task of reconstruction rapidly.

A separate 11-member Development Assistance Coordination and Facilitation Committee will be formed with a CEO at helm and include national and international development partners and civil society representatives.

Reconstruction Authority's salient tasks

- To determine total loss due to earthquakes
- To acquire necessary land following legal procedures
- To order authority concerned to remove physical structures after providing compensation to owners
- To coordinate with different bodies for effective implementation of reconstruction work
- To order owners to remove their damaged structures or to remove them at their cost.

The authority would direct the concerned ministries to accomplish necessary work of reconstruction providing them with necessary budget from a separate fund created for reconstruction work.

12. Challenges, Gaps and Lessons Learnt

It is still early to assess the total impact of the 2015 Nepal Earthquake. There were psychosocial consequences of that devastating earthquake disaster. The nightmare and traumatic situation caused by the disaster upon many people **particularly among the children and adolescents** are still there and may remain for a prolonged time.

The following challenges and gaps were identified after the earthquake:

- 12.1 Search and Rescue (SAR) works carried out by the security personnel of Nepal and foreigners was commendable. But it was slow and inadequate while they failed to reach in due time in the remote, rural and hilly areas and it was not well-organized. Of course, sometimes it was compounded by the lack of equipment, road network, transport, and well-trained skilled human resources.
- 12.2 Delay and serious lapse in damage and need assessment was felt almost all the time. Due to this although there was high number of international SAR team they could not contribute considerably as expected. Hence, the productivity of the international teams was not in compatible with the heavy investment upon them.
- 12.3 Emergency warehouses, prepositioning of relief materials with proper inventory were also lacking.
- 12.4 Debris management was found as one of the big problem basically because of the lack of debris management equipment, tools and techniques.
- 12.5 Accurate and proper communication between District Emergency Center (DEOC) and Central Emergency Operation Centre (EOC) was not effective.
- 12.6 Identification Cards to the affected of ID cards to affected families for systematic relief distribution.
- 12.7 Although the response phase was over some International Search and Rescue Teams remained unnecessarily for a prolonged time causing burden to the concerned government budget.
- 12.8 Most of the personnel from international organizations worked in tourist visa which is actually illegal.
- 12.9 In addition to the identified 82 open spaces, more open spaces are required.
- 12.10 A weak database and an absence of modern technology were other bottlenecks for poor response in Nepal.

What are the lessons? –

Critical areas of concern of the Nepal Earthquake can be summarized as following:

- a) Lack of awareness as well as coordination among disaster management stakeholders;
- b) Inadequate attention to structural mitigation measures in the engineering education syllabus;
- c) Weak law enforcement and monitoring of building codes and town planning;
- d) No licensing system for engineers and masons;
- e) Absence of earthquake resistant features in non-engineered construction in sub-urban and rural areas;
- f) Lack of training for professionals in earthquake resistant construction practices; and
- g) Lack of adequate preparedness and response capacity among various stakeholder groups.

The biggest lesson Nepal learnt from this earthquake is that the threat of earthquakes will never end while Nepal is in seismically very active zone. The best way to be safe from earthquake hazards is to build earthquake resistant infrastructures. There should

be no COMPROMISE in building earthquake resistant infrastructures. Hence, this is high time to Build Back Better (BBB).

All most all casualties were due to the collapsed infrastructures. Another lesson we learnt is that if similar high intensity earthquake in the U.S.A., Japan or other equally developed nations do not lead to enormous loss and damage to human lives and physical properties as the infrastructures in these countries are earthquake resistant. This emphasizes the need for strict compliance of town planning bye-laws and building codes in Nepal.

It has been realized that in the past the government did not paid due attention to Disaster Risk Reduction (DRR). DRR has not been a priority for the government. The government was found too weak in preparedness at all levels. Inadequate legal instruments and poor implementation of existing legislations have also been identified as a factor for losses and damages. The government was never serious in DRR. **Not only the government, but also the NGO and INGOs were entangled with mounds of paper work (preparation of reports etc.) and discussions (seminars, workshops, interactions, meetings, visits etc.). Overall, less emphasis was given to actual hardware considerations. Resource constraints and managerial weaknesses were and are still there.**

13. Way Forward and Conclusions

Nepal faces an enormous challenge from major disasters like the devastating earthquake of 25 April 2015. Therefore, long-term and sustainable efforts are required to address the problems of earthquake hazards in Nepal. Although disaster management and risk reduction may be considered expensive in the light of competing demands for resources in a developing country like Nepal, this is high time for the government to invest on considerable activity and resources into preparing for and responding to familiar and unexpected emergencies and disasters before the human and economic consequences of inaction are extensive, unmanageable and more expensive. This paper suggests some basic principles and guidelines to reduce the impact of the potential future earthquake disaster not only in Nepal but also for other earthquake prone countries as well. Following are the basic and fundamentals for earthquake management in Nepal and beyond:

- 13.1 Construction of earthquake resistant infrastructures;
- 13.2 Selective seismic strengthening and retrofitting of existing priority structures and lifeline structures – a priority list for structural safety audit, seismic strengthening and retrofitting is required;
- 13.3 Effective implementation of Building Code and other legislations;
- 13.4 Mass awareness and preparedness;
- 13.5 Capacity development through education, training, research & development (R&D), documentation and information sharing;
- 13.6 Effective and efficient response during and after emergency.

The above basics are necessary to reduce the impact of earthquakes in the short-term as well as in the medium and long-term. They recognize the enormous challenge in improving seismic safety because of the inadequate numbers of trained and qualified civil engineers, structural engineers, architects and masons proficient in earthquake-resistant design and construction of structures. They also recognize the need for imparting training in earthquake-resistant design and construction to faculty members in professional courses and for creating mass awareness on earthquake and other disaster risk reduction features in non-engineered construction in earthquake prone areas.

14. Conclusions

As the impacts will forever affect landscape, people, society, and livelihoods in Nepal – there is no choice but to adapt to disasters. Living not only with earthquakes, but also with many other disasters in daily life is the destiny of Nepalese people. Yet, the Nepalese and their neighbors and friends all over the globe, have to reconcile themselves to the fact that tens of kilometers beneath where they live, the Indian and Eurasian plates will continue their tussle again and again. In that journey, they must build on the fundamental strengths they possess—social capital and community resilience. Despite a weak government and post-conflict political instability, the presence of community-based institutions at sub-national levels maintain a social cohesion and play a constructive role in managing services like drinking water, electricity, forest, and even developing infrastructure such as trail bridges. As the Nepalese move forward, they must allow competing visions, strategies, institutional cultures, resources, and perspectives to be expressed and articulated as democratic deliberation. The fact is that tremendous challenges lie ahead for the government, semi-government, and private organizations to collectively work towards addressing the urgent needs of the nation and its people who have been severely affected by this natural calamity.

Of course, the government of Nepal should be at the forefront of any effort to rebuild Nepal responsibly and prepare the country for future earthquakes. To rebuild Nepal, the government should call on experts inside and outside the country to engage in interdisciplinary collaboration. Non-governmental organizations, the private sector, experts, intellectuals and the media can contribute in the rebuilding and disaster-preparation efforts and working collaboratively and effectively. To successfully rebuild Nepal, the government will surely need a huge amount of funds.

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Biographies

The author, **Meen B. Poudyal Chhetri** earned his Post Doctorate in Disaster Management Policy from the Queensland University of Technology (QUT), Brisbane, Australia. He also holds Ph. D., Master's and Bachelor's degree in Economics and International Law. Currently, Prof. Chhetri is the President of Nepal Center for Disaster Management (NCDM) and Chairman of The International Emergency Management Society (TIEMS)'s paper Review Committee. He is the Adjunct Professor at the Queensland University of Technology, Brisbane, Australia since 1 March 2009. He served as the Director of the Department of Disaster Management of the Government of Nepal from 2001 to 2003. In 2004 He worked as the Deputy Regional Administrator in Hetauda, Nepal. From 1995 to 1996, he was the Chief District Officer and Chairman of District Disaster Relief Committee in Dhading district of Nepal. Prof. Chhetri also held positions of Under Secretary, Investigation Officer and Special Officer in various government agencies of Nepal including the Commission for the Investigation of Abuse of Authority, Ministry of Home Affairs, Ministry of Finance, Ministry of Agriculture and Ministry of Education. Prof. Chhetri is the author of two books and a number of research articles that are published in national and international journals. Prof. Chhetri awarded with AEI Australia Alumni Excellence Awards 2014 by the Government of Australia on 20 January 2014. On 13 October 2014, he is awarded with "DPNet Award" by the Government of Nepal. He is also decorated with several national medals and awards in recognition to this contribution for the development of the nation.

Acknowledgements

Kind acknowledgements and sincere thanks to TIEMS President Kare Harald Drager, TIEMS Italy Chapter President Mr. Vittorio Rosato and all others involved in the organization of the

TIEMS Annual Conference in Rome, Italy for their support and friendly invitation to me as the Keynote Speaker at the great event.

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