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CHALLENGES AFTER EARTHQUAKES: LESSONS LEARNT FROM THE 2015 NEPAL EARTHQUAKE

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Abstract: Concurrent rebuilding situation of Nepal after 2015 earthquake was analyzed on the basis of information obtained from field visits, hearings with responsible officers engaged in emergency support and reconstruction activities, and referring the published government reports. Finally, measures to be taken in order to solve the post-disaster rehabilitation difficulties and being prepared for future such disaster in Nepal are discussed.

Key words: 2015 Nepal Earthquake, emergency relief, rehabilitation, reconstruction

1. BACKGROUND

The 2015 Nepal earthquake occurred at 11:56:26 local time (UTC+5:45) on April 25, 2015. As per the National Seismological Center (NSC) Nepal, the epicenter lied beneath the Gorkha district, situated about 80km northwest of capital Kathmandu and had the magnitude of M7.6. May 12 aftershock (M6.8) had the epicenter in Dolakha district, about 70 km North-east of Kathmandu. Ministry of Home Affairs (MoHA) Nepal data shows that total of 8962 precious lives were lost and large number of buildings collapsed (Table 1). The scale of building damage clearly shows that prime cause of human casualty was no other than weaker dwellings.

Earthquake vulnerability was not a new topic in Nepal. Various historical records (Chitrakar and Pandey, 1986; Bilham, 2004; Mugnier et.al, 2013) show that following earthquakes of magnitude above M6.5 occurred in the past (year and magnitude): 1255, 1260, 1408, 1505, 1681, 1767, 1810, 1823, 1833 (8.0), 1869 (6.5), 1916 (7.0), 1934 (8.0), 1936 (6.8), 1980 (6.5), 1988 (6.9). Recurrence interval of big earthquakes at about 70-80 years could be noticed. Earthquakes over M4.5 occurred in the last 100 years are plotted in Fig. 1 and it clearly shows that the subduction zone between Indian and Eurasian Plates under Nepalese territory is seismically active.

Administratively, Nepal is divided into 5 development regions, 14 zones and 75 districts. At the time of earthquake, the zonal administration was non-existent and role of the development region chiefs was also insignificant therefore, law and order situation of the country was being enforced by MoHA through the district administration offices situated in all 75 districts. Other line ministries also had their own district and regional offices to implement plan and policies throughout the country. Provision of elected body was there in the constitution at district, VDC and municipality level in addition to member of parliaments at national level. However, with the expiry of the five-year term in 2002, the local bodies were without people's representatives for almost 14 years. Officers deputed from Ministry of Federal Affairs and Local Development (MoFALD) to look on the developmental activities were also taking elected representatives' role in these years.

Table 1. Damage data of 2015 Nepal earthquake

Earthquake (Magnitude, NSC)	Name	Human Casualties	Injured Persons	Building damage		Reference
				Fully	Partially	
2015 Nepal (M7.6 & 6.8)		8962	22302	775782	302774	drportal.gov.np data accessed on 2017/03/16

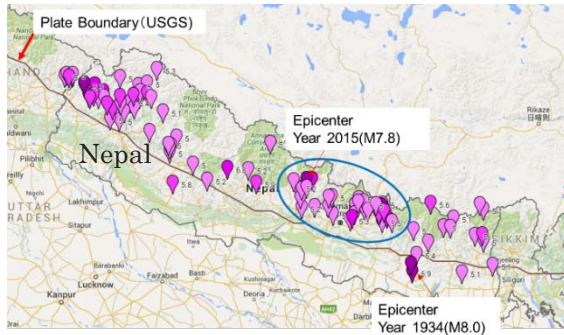


Fig. 1. Earthquake records above M4.5 occurred in the last 100 years (USGS data on Google map)



Fig. 2. Earthquake damage scenario (PDNA)

On the legal framework to deal with disaster in Nepal, it is primarily based on the Natural Calamities Relief Act (NCRA) adopted in 1982 for the management of relief operations as well as protection of lives and properties headed by MoHA. Government of Nepal (GoN) has endorsed national strategy on disaster risk management, NSDRM. The national disaster response framework, NDRF (2013) prepared further details the disaster preparedness by clarifying the roles and responsibilities of government and NGOs involved in disaster risk management. As per the NDRF and NCRA, the Central Natural Disaster Relief Committee (CNDRC) and District Disaster Relief Committees (DDRC) in each of 75 districts are given the leading role during disasters and the site visits of our team also confirmed that they played very crucial role immediately after the earthquake in 2015. Besides forming the system and committees to deal with disaster, DUDBC had prepared and implemented a Nepal National Building Code (NBC) in 1993. Furthermore, undertakings of KVERMP (2000), JICA (2002), ERRRP (2007-2009) projects showed the seriousness of Nepalese government in mastering disasters mitigation methods in recent years. Although government preparedness, various awareness programs targeted to school children, meetings and seminars appeared to be going on before the earthquake, very high human casualty figure of 2015 earthquake tells us that the efforts were insufficient and did not reach to the grass-root level.

In order to prepare this paper, total of three site visits to Kathmandu, Nuwakot and Gorkha districts were done in the past after 5, 12 and 18 months of the earthquake to assess the damage and rebuilding situation. Information was collected from the field surveys and hearings with responsible officers of National Reconstruction Authority (NRA), Department of Urban Development and Building Construction (DUDBC), Sankharpur municipality and Karyabinayak municipality. By also including the current rebuilding situation from the published government reports, post-earthquake rehabilitation aspect are analyzed and measures necessary to minimize the damage from future such disasters will be discussed. No visits were done during emergency period so, any reflection in the paper is limited to literature study and field hearings done afterwards.

2. SCENARIO AFTER EARTHQUAKE

2.1 Damage situation and emergency relief

Almost 200 kilometers stretch extending east-west in between the epicenters of the main shock and the most powerful aftershock suffered a heavy damage. There were big landslides, large destructions of private and public buildings (Table 1), heritage sites, schools and health posts (refer Post Disaster Needs Assessment, PDNA, 2015). Among the 31 badly affected districts out of the country’s 75 districts, 14 were the worst hit. Emergency was declared in these 14 districts; Sindhupalchowk, Kathmandu, Nuwakot, Dhadhing, Rasuwa, Gorkha, Bhaktapur, Kabhrepalanchowk, Lalitpur, Dolakha, Sindhuli, Ramechhap, Makawanpur and Okhaldhunga in order to prioritize the rescue and relief operations and the Chief District Officers (CDOs) at district administration offices took the lead of DDRC according to NCRA. With the news records of emergency cabinet meeting held within a few hours, it seems that state power was mobilized instantly. Nearly 7000 schools were significantly damaged (PDNA, 2015). Being a holiday, it was considered that school children’s mass casualty was prevented. However, Nepal Police report (August 1, 2016) shows the following information (Fig.3) of deceased persons according to the age range and it tells us that not so many children were lucky to escape the evil shaking. As per PDNA, almost 130000 military, para-military and police forces were in the field for rescuing besides the government officers.

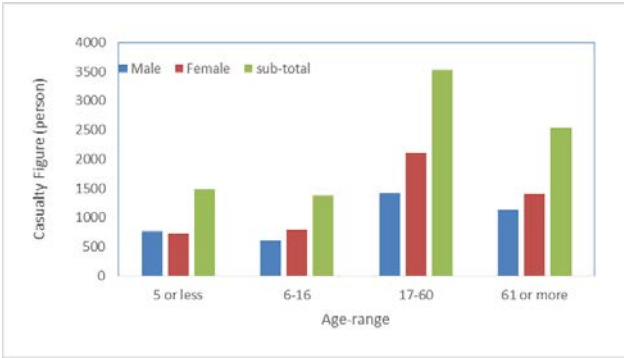


Fig. 3. Human casualty distribution on 2015 Nepal earthquake by age range (Source: Nepal Police report (August 1, 2016))

The state of initial help on emergency shelters to the peoples could be observed from the excerpt of the deputy prime minister’s speech made in the house of parliament after 13 days of earthquake; 1) within 2 days, 50,000 tarpaulin sheets were distributed but no more could be arranged because there was no stock. Until May 8, about 500,000 tarpaulin sheets were already distributed through NGOs and another 400,000 were being purchased, 2) total of 44 helicopters were used in rescue operations but were insufficient to rescue the needy persons. Among them, those arrived from foreign countries started working very late, and 3) to arrange the temporary shelter, two bundles (~22m x 0.85m x 2) of corrugated galvanized iron (CGI) sheet was committed for affected families.

A report by Nepal Police (May 6, 2015) shows that more than 45 countries extended their help in the form of medical, search and rescue (SAR), foods and tents. Some neighboring team even arrived on the same day. Because of a very difficult terrain, however, state help could enter very late at many remote areas. It is therefore, understood that local villagers at remote places must be deprived of food items on initial days while rescuing their localities themselves. In Kathmandu, the capital city, many old and heritage buildings collapsed but new buildings had survived. However, having no well-defined instructions for evacuation and insufficient disaster education, peoples were crowded at open spaces and parks with the fear of continued aftershocks.

2.2 Reconstruction phase

Establishment of NRA marks the formal start of reconstruction phase. NRA was realized in August 2015, just after 3 months of disaster as an independent agency to deal with disaster related activities. However, it became non-functional due to legal hurdles and could regain an official status in December 2015, almost after 8 months. The working period set for NRA is five years with the maximum one year possible extension.

NRA handbook (2016) published in April 2016 details the reconstruction allowances for private owners and the processes for application. The grant allowance of NRs. 200,000 per affected family will be given in three installments (NRs. 50,000, 80,000 and 70,000) as the construction progresses. With NRA decision in September 2016, the grant became 300,000 and installments changed to; NRs. 50,000, 150,000 and 100,000 respectively. There is an additional provision of NRs.300,000 loan with community guarantee at no interest. If this loan has not been taken, NRs. 1500,000 or NRs. 2500,000 loan, may be received at nominal interest rate (2%) depending upon the construction location being outside or inside of the Kathmandu valley.

Regarding the NRA housing grant distribution rules aimed at private owners, the following documents are to be submitted by beneficiaries to receive the grant allowance for rebuilding their houses; 1) citizenship certificate, 2) landownership certificate, and 3) the paper given by the surveyor while categorizing the damage. Most of the adults already have citizenship certificate at their hand. If anyone has land, landownership certificate is also not a problem. A copy of both 1) and 2) can be obtained if the originals are lost. There is an alternative for No. 3 if the person has lost original paper but if he/she is listed as beneficiary. In brief, the paper requirements are not so complex. Delay in NRA formation has delayed the reconstruction activities during initial days but NRA outputs are gaining momentum along with the experience. The number of agreements made and first installment of NRs. 50,000 transferred to beneficiaries' bank provide some hints on this trend (Fig. 4).

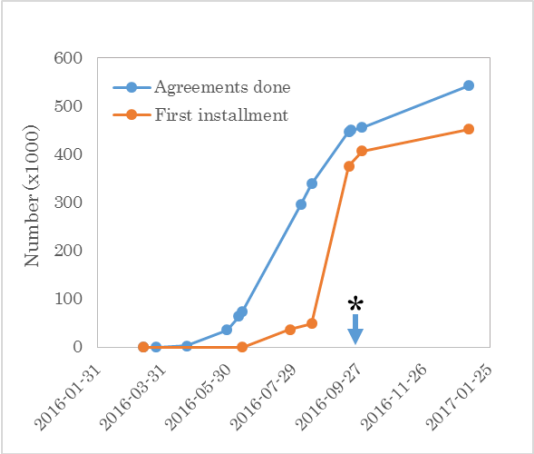


Fig. 4. Reconstruction progress of private housing (Source: NRA press notices) (*: NRA decision to increase grant allowance for earthquake victims to NRs. 300,000

3. FIELD OBSERVATIONS

A few of the case examples from site visits will be described in the following paragraphs in order to convey the general message about field situation. In the first visit made on September, 2015, NRA was established at the center (that met with legal trouble later and reconstituted), but DDRCs, who were working according to NCRA since the day after earthquake, were waiting for the guidelines. There was a countrywide blockade that restricted gasoline items from entering into Nepal therefore, supply of emergency items was disrupted. During April 2016 visit, the gasoline blockade was partially lifted and transport of emergency supplies to earthquake victims was resumed. NRA was reformed just before 4 months and had started signing agreements with beneficiaries (Fig. 4). Having insufficient technical manpower at the site, about fourteen hundred engineers and sub-engineers were

recruited by DUDBC and dispatched to the site almost after a year of earthquake.

3.1 Initial relief works by DDRC offices

In September, 2015, Nuwakot DDRC office detailed about the relief distribution of NRs. 2,000 for food and 5,000 for shelter as an immediate relief amount given to all 76,500 affected families. In the second phase, NRs. 15,000/family for buying CGI sheet of temporary shelter was also distributed by DDRC. This was reconfirmed later while surveying the peoples. About 6 NGOs were helping to build houses there but did not cover all families. The task of dismantling, debris management and repairing school buildings was taken as a big challenge before DDRC as no proper equipment existed.

3.2 Historical sites still to get attention

Photo 1 shows the Basantapur Durbar Square and other two other adjacent temples, one of the most famous tourist attractions in Kathmandu city, under temporary supports. Photo 2 is the same Durbar Square, photographed at various dates and these well state that many archeological monuments are yet to get government attention until recently. Similarly, other places, such as, Gorkha Durbar in Gorkha, temples in Patan and Bhaktapur were also found untouched until September 2016. In a country, where tourism constitutes a large share of GDP, keeping them without renovating is costing a lot economically. The NRA progress report published on December, 2016 shows the work progress of archeological monument restoration as; completed- 15, undergoing-69. As PDRF plan for reconstruction of monuments is also 4 to 5 years, long waiting time for full recovery is expected.



Photo. 1. Two temples and Durbar Square in Basantapur area under temporary supports (Photo taken on Feb. 2017)



Photo. 2. Basantapur Palace in Kathmandu; a) Before earthquake (Photo credit : Wikimedia Commons, Dipkiran), b) Sept, 2015, and c) Feb, 2017.

3.3 Special building Bye-laws were being waited

The Sankharpur municipality at Sankhu historical area (Fig. 5), which got its municipality status about a year before the earthquake and is located just 30 km from the capital, was heavily damaged. Local hearings confirmed about 90% damage of these mud-mortared brick buildings. UNESCO (2015) provides the glimpse of immediate damage. Similar damage was also noticed in the core area of Bungamati town in Karyabinayak municipality of Lalitpur district. Interviews with officers at respective places revealed that the core areas at both locations were built in smaller plots and had narrow roads. As NBC requirement on road setback, plot size and so on cannot be fulfilled, special building bye-laws are expected to go for newer settlements. Besides, these core areas have traditional values and falls under heritage location to be preserved. The regulation, supposed to be produced by MoUD, was yet to reach the municipalities and as per them, delaying reconstruction process.



Fig. 5. Location map of field survey done at Sankharpur and Karyabinayak Municipality in Kathmandu valley

3.4 Reconstruction progress with time was obvious

In Sankhu, where the building damage was as high as 90%, the streets were filled with debris and there were so many walls or even whole buildings in ready to fall condition in September 2015. However, the roads were mostly cleared and building construction cases were rising in the next visit done after a year of earthquake as symbolically shown by the photograph (Photo 3, 4 and 5) taken at different dates.



Photo. 3. Ready to fall buildings and streets still to be cleared even after six months (Sept, 2015)



Photo. 4. Streets rubbish partly cleared and a few new buildings coming up (April, 2016)



Photo. 5. New buildings on private funding coming up (Sept, 2016)

3.5 Longer stay in poorly built and unhygienic temporary shelters was too stressful

With the visits of Keureni, Tupche and Charghare villages in Nuwakot district and in the vicinity of Gorkha bazaar, families having agricultural plots around their original residence were found living on their own land by preparing shelter with government provided CGI sheets (Photos 6a) and had built WASH facilities themselves. In Photo 6b, a family from Rasuwa district having 9 family members were living in some other's land temporarily by supporting the owner's farming. While having difficulties of residence, they could produce vegetables and other agricultural products for living.

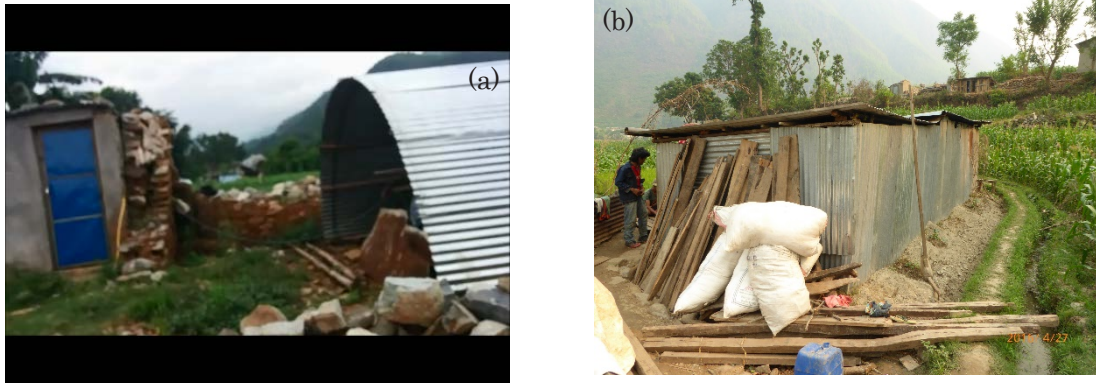


Photo. 6. Typical private temporary shelter houses made of CGI sheets (a) Keureni, and (b) Tupche in Nuwakot (Photo taken in September, 2015)

In Sankhu, a family was interviewed in September 2016, whose family head was trapped inside the building during the earthquake but could get out after 4 hours with the help of relatives and neighbors unhurt. They prepared two rooms with the CGI sheets provided and all 10 family members were living in that small space (about 1 year, until then). However, detailed survey of this area was not completed until then so, peoples were suspicious about receiving government grant designated for earthquake victims. Most importantly, the stay in these vulnerable shelters are getting longer than expected.

3.6 Difficulties in rehabilitation

3.6.1 Shelter Camp on municipality land

Betrabati Shelter Camp (Fig.6, Photo 7), which was just a few minutes' drive from district headquarter at Bidur was visited in September, 2015. Representatives informed that total of 304 families, about 1375 persons, were living there. Peoples from Haku VDC of Rasuwa district (adjacent to Nuwakot district at the north) came in mass after about a month of earthquake and were living in temporary camps there because their original village was destroyed by landslide. It was understood that almost 90% were from Rasuwa district. There are 36 families from Bhalche VDC of Nuwakot as well. Some NGOs had built water supply system, lavatory and were also helping with food items. They were sending their kids to nearby school, about 15-20 minutes walking distance from there and this is not so far as compared to adjacent villages. The difficult part of living was that the space allotted to each family was very small, the expected time of stay was quite long and they did not have any agricultural land in the vicinity to produce anything for survival.

The condition was almost unchanged during the second visit made on April 2016. There seems to be some unseen conflict of interest among various parties involved. The NRA has the policy to settle the affected peoples near their original place but many residents of that camp opt to settle there because of its proximity to Nuwakot district headquarter and having better chance of getting job. Besides, the land belonged to Bidur municipality and might have commercial interest in it and, like to see the central government or the Rasuwa district to settle its residents.

3.6.2 Settlement on Government land

Some private house owners at Trishuli, Bidur Municipality ward number 10 were interviewed in April 2016. There were many houses built on the land belonged to Nepal Electricity Authority (NEA), a government agency. One typical family surveyed had the following details. The head of the family, a man, was a priest at Buddhist Monastery and was living with 5 family members. His 1-story house, built about 15 years back, was partially damaged but no one was killed. The family head claimed that he was staying at this place since 1965. They did not have any other land. They were repairing the house by taking loan but were afraid if government would provide any subsidy. Government help they received until then was $2000 + 5000 + 15000 + 10000 = 32000$. Some organizations provided eatables, blankets and so on besides those funds.

This case might fall under government land encroachment. In the past, genuine landless peoples were given the residential plot by forming commissions at national scale. Therefore, those occupying landless persons might be expecting the same. If the claim of occupancy since 1965 is believed, it is not unnatural as well. It seems that the government was simply neglecting the case during those years. The worst condition now after the earthquake is that their houses are damaged but getting government support for rebuilding is not possible because the land does not belong to them. Having no countrywide digital data of land ownership, identifying the genuine also take some time for the government. Although it is expected that it will be settled by providing land to landless people, some delay is expected in rehabilitation.

3.6.3 Relocation of vulnerable settlements

Laprak village in Gorkha district, very close to epicenter, and many villages in Langtang valley in Rasuwa district were swept away by landslides due to the earthquake. There are many other villages at critical condition. Amongst the 475 locations required to check the vulnerability, field hearings and NRA press release (December, 2016) confirms that study was completed in 117 places and 56 were identified as having serious problems, needing resettlement. Mostly looking at available government lands, alternative places for the new settlement are yet to be identified.



Fig. 6. Location of Betrabati shelter camp, Nuwakot



Photo. 7. Betrabati shelter camp, Nuwakot (April, 2016)

3.7 Extracts from hearings and references

3.7.1 Budget challenges

With PDNA, GoN had estimated about USD 6.7 billion need for the post-disaster recovery. During International Conference on Nepal's Reconstruction (ICNR), the findings in PDNA was made public and call for monetary support was issued. Donors' pledge of support about USD 4.1 billion in the form of grants and loans was made public then. As per NRA Rebuilding Manual (2016), only about USD 3.4 billion was for reconstruction and the rest, USD 0.7 billion was for regular programs of donors. Within that, MOU was done for USD 1.2 billion by March 2016 (PDRF) and for USD 2.7 billion by September 2016. Now, the original estimate of USD 6.7 billion has been revised to USD 9.2 billion by incorporating the increase in housing allowance to NRs. 300,000 and also making provision of NRs. 100,000 for repairing the houses (not yet decided but). While another less affected 17 districts are yet to be funded, more revisions are expected in near future. In this way, a large gap between the required and available fund can well be noticed. Additionally, as some donors have put condition to work in specific areas, the pledged amount cannot be freely used by NRA. While not impossible, it is therefore, a herculean task for NRA to finish the planned work in stipulated time.

3.7.2 Implementing National Building Code, NBC

Field visits showed sufficient trend that older buildings took the major share of fully damaged buildings. The National building code (NBC) of Nepal was prepared in 1993 but the problem lied on implementation side because it was not the must-to-follow rule but municipalities or VDCs had the power to say YES or NO. Therefore, only some large municipalities, having sufficient income and manpower, had adopted it and for rest of the country, the NBC never existed.

In order to fill this gap after 2015 earthquake, MoFALD (2016), a guideline published in August, 2016 aims to implement the code countrywide. This is still not mandatory and needs local government body's (VDC and municipalities) approval before being enforced. The big task for GoN is to avail the required skilled manpower capable of monitoring engineering works in all VDCs and municipalities.

3.7.3 Research on cheaper building material

With the survey of damage assessment inside Kathmandu valley completed, number of beneficiaries has crossed 626000. Millions of CGI sheet bundles and hundreds of tons of steel rods would be required even to construct these simple houses from Design Catalogue (2015). On the other hand, the grant amount is said to be insufficient for construction and many people in poor economic condition many not have bank balance to supplement the deficit. Finding alternative cheaper material, rather than just stressing the strength aspect, can solve this issues as well as lessen the large import need of iron products.

4. DISCUSSIONS

Following the 2015 earthquake, many peoples were displaced because of the full or partial collapse of their residences. Some form of post-earthquake rehabilitation steps; Step 1) evacuation, Step 2) transition shelters and, Step 3) support in arranging permanent places of living, were observed in Nepal but in a very crude form.

Step 1): The basics of disaster preparation step, setting evacuation centers, was missing even in larger municipalities with a lot of income so, setting of the same in rural area is going to take more time in Nepal. Temporary evacuation centers were however set in local parks or open spaces and many peoples including those having strong buildings had also crowded the space because of the fear from continued shakings and therefore, the actual data is not so clear. The records showed that a lot of tarpaulin sheets and tents were distributed.

Step 2): This step of ‘transition shelter’ might be said to have covered with the distribution of CGI sheets which, all of the peoples surveyed in Gorkha and Nuwakot had received. It was undertaken by DDRCs before NRA took its shape. Although the shelters prepared by individuals without toilets and bathrooms were neither safe nor healthier for a longer stay, the delay in NRA formation, its slow initial efficiency and unsettled issues (mostly land-related) have ultimately making the stay longer and creating a lot of stress to earthquake victims.

Step 3): Regarding the rehabilitation stage, the most common public opinion was about insufficiency of grant amount to build the house and having neither bank balance nor a job to fulfill the deficit. Not many of them were considering additional loan provision at minimal interest rate (2%) because of not having any source of income to pay back the loan. Grant assistance rules are clear and arranging required papers seems not so difficult so getting first installment of NRs. 50,000 may not be so difficult for those having residential land. The problem appears when the residential land does not belong to the beneficiary and he/she does not have land elsewhere. When it is government land encroachment case, it adds further complexity because in such cases, peoples who are not landless are also showing their presence for monetary benefits. For peoples shifted to another districts, such as Betrabati shelter camp case, the case is more difficult because government plan and directives are to settle peoples in original VDC or nearby ones, and not outside of the affected district.

Some additional problem is likely to come in second stage when the grant amount are not sufficient to build a house and low-income people cannot arrange the deficit. Furthermore, another aspect to invite problem could be the NRA’s rule in grant assistance that says, ‘If the person is on the beneficiary list and has already started construction, grant may be given if the structure is found to be earthquake-resistant after being approved by the designated engineer’. If the engineer does not find the structure satisfactory after its completion, the problem will be difficult to resolve. In addition, regarding the group housing schemes to be undertaken by various NGOs/INGOs, funding limitation for each household and in infrastructures may also invite some dispute.

On the resettlement issue of the vulnerable settlement, alternative places of new settlement for other locations are yet to be identified. Recent government decision made in April, 2017 in providing compensation to buy a land and settle in nearby places or districts had initiated the first step in this direction but more issues may appear during implementation.

In brief, peoples are still waiting in narrow CGI-roofed and -walled houses for further processes, it took more than a year to identify the earthquake beneficiaries inside Kathmandu valley and peoples of less affected areas are still to get attention. Villages at vulnerable locations are still waiting for NRA rescue. Therefore, although NRA has done a lot progress in a short time, there is more to be done and more speed is demanded. NRA has prepared a Post-Disaster Recovery Framework (PDRF) in May 2016 detailing the future steps in recovery and there is no point why we cannot be optimistic on its performance in future.

5. CONCLUSIONS AND RECOMMENDATIONS

- 1) Peoples suffered a lot just after the earthquake because the basics of disaster preparation, i.e., designating evacuation centers, keeping emergency food stocks and starting disaster education in schools, was missing and therefore, they need to be realized very soon. If schools are strengthened and become evacuation centers, it will also prevent mass killing of children due to school building collapses, which luckily did not happen this time because of a holiday.
- 2) Government help in providing transitional shelters was almost limited in providing CGI sheets. Many of the shelters were found unsafe and unhygienic. Although settlements in group got some assistance from NGOs/INGOs to install water supply, sanitary and hygiene (WASH) but not the individual ones. So, technical help in constructing temporary shelters (design, skilled manpower) including WASH aspects in a set shall be considered in future.
- 3) NRA rules on grant distribution for landless peoples is delaying the rehabilitation and need to be more inclusive. Solving country's landlessness situation beforehand will obviate such issues.
- 4) Resettlement of villages found critical by NRA surveys needed immediate NRA attention.
- 5) 'Prevention is better than cure' so, building code (NBC) implementation shall be immediately started throughout the country by also including some provision of strengthening older structures. The urgency shall be felt from the 13000 deaths in India by Bhuj earthquake (Mw7.7) in 2001 (Hokugo, 2016), 87000 lives (EERI, 2006) by Kashmir earthquake (M7.6) in 2005, and similar others, due to the damage of non-engineered buildings, constructed with unreinforced stone or brick masonry.
- 6) Found not effective during last earthquake, expectation is on government's commitment in developing an independent disaster mitigation center in all districts, VDCs and municipalities. In addition, speeding up the community development and volunteerism (such as BOKOMI, 1995) will help framing more resilient disaster mitigation system.
- 7) State-owned residential facilities helped a lot in arranging transitional and permanent housings for post-disaster rehabilitations in Japan (Kobe, 2010; Kumamoto Roadmap, 2016). Availing private houses at subsidized rents are also taken as an alternative. Having no state-owned rental apartments, the second option can become a possible guideline for Nepal.
- 8) Finally, GoN is now focused in rehabilitation of victims of the year 2015 earthquake, i.e., mainly in 14 most affected districts. While budget challenge is there to realize PDRF plans, even after successful completion, only a part of the country will have new and stronger houses, remaining areas are going to be left untouched. It is a great concern if so many dilapidated residences scattered across the country will get attention before it is too late.

6. REFERENCES

- Bilham, R. (2004). Earthquakes in India and the Himalaya: tectonics, geodesy and history. *Annals of geophysics*, Vol. 47, No. 2/3, pp. 839-858.
- BOKOMI (1995). 'Disaster Prevention Welfare Community' in Kobe city started in 1995 with the lesson learned

from the Great Hanshin-Awaji Earthquake (<http://www.city.kobe.lg.jp/safety/fire/bokomi/index.html>).

Chitrakar G.R. and Pandey M.R. (1986), Historical earthquakes of Nepal, Bulletin, Geological Society of Nepal, 4, pp. 7-8.

Design Catalogue (2015). Design catalogue for reconstruction of earthquake resistant houses. Volume 1, published by GoN, MoUD, DUDBC.

EERI (2006). The Kashmir earthquake of October 8, 2005: Impacts in Pakistan. Special earthquake report, EERI, February, 2006.

ERRRP (2009). Earthquake risk reduction and recovery preparedness program for Nepal, <http://www.errrp.org.np/>.

Hokugo, A. (2016). A Comparative Approach to the Post-2001 Gujarat Earthquake Recovery in India, Asian Law in Disasters Toward a Human-Centered Recovery, Edited by Yuka KANEKO, Katsumi MATSUOKA, Toshihisa TOYODA, Routledge, pp. 291-299.

JICA (2002). The study on earthquake disaster mitigation in the Kathmandu valley, kingdom of Nepal. Report submitted to Ministry of Home Affairs, Nepal.

Kobe (2010). Comprehensive strategy of recovery from the great Hanshin-Awaji earthquake. A report prepared by Kobe city.

Kumamoto Roadmap (2016). Restoration and reconstruction after 2015 Kumamoto earthquake. Revised on December, 2016 (<http://www.pref.kumamoto.jp>, in Japanese).

KVERMP (2000). Kathmandu Valley Risk Management Project report under Asian urban disaster mitigation program, 2000.

Mugnier, J.L., Gajurel, A., Huyghe, P., Jayangondaperumal, R., Jouanne, F. and Upreti, B. (2013). Structural interpretation of the great earthquakes of the last millennium in the central Himalaya. Earth Science Reviews 127 (2013), pp. 30-47.

MoFALD (2016). Ministry of Federal Affairs and Local Development guideline (in Nepali) in August, 2016.

NRA handbook (2016). Housing reconstruction program, document explaining the process of grant assistance of private residential buildings damaged during earthquake, 2nd version (in Nepali).

NRA Press Releases: Online. <http://www.nra.gov.np/>. Accessed on various dates until April, 2017.

NRA Rebuilding Manual (2016). NRA Publication, newsletter (Oct 2016-Jan 2017).

UNESCO (2015). 2015 earthquake damage assessment, Sankhu (Nepal), published on 18 Oct, 2015.

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(NRs. - Nepalese Rupee, 1 USD = NRs. 100 is considered for discussion purpose)

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