UNDERSTANDING SEISMIC RISK PERCEPTION OF DIFFERENT KEY NEPALESE STAKEHOLDERS FOR DESIGNING APPROPRIATE DISSEMINATION STRATEGY FOR EARTHQUAKE-RESISTANT CONSTRUCTION

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ABSTRACT:

Effective implementation of Earthquake Risk Reduction programs requires positive risk perception by the key stakeholders. Risk perception is the internalization of knowledge on the earthquake risks and reduction measures and motivation towards it. The risk perception in one hand is constituted by the level of knowledge and awareness and on the other hand it depends on the motivational factors also. Motivation is dependent on social, cultural and economical factors. Hence understanding the level of risk perception of the key stake holders, which includes home-owners, masons, designers and supervisors, regulatory and implementing authorities and traders, is very important in designing the models for implementation of earthquake risk reduction programs.

Survey on risk perception by different stakeholders (house owner, Mason and contractor and government officials in central level and local level) was done in different areas of Nepal as part of a Collaborative Research and Development Project for Disaster Mitigation in Earthquake Prone Areas of Asia implemented jointly by Building Research Institute (BRI), Japan, Graduate Research Institute for Policy Studies (GRIPS), Japan and NSET.

This paper presents the outcome of the survey, factors to be considered while designing strategies for earthquake risk reduction program and lesson learned during the risk perception survey.

KEYWORDS: Risk perception Community, Stakeholders, awareness, Implementation, Training

1. INTRODUCTION

Nepal sits astride the boundary between the Indian and Tibetan Plates along which a relative strain of 20 mm per year is believed to be generated. Earthquake catalogue of Nepal suggests that Kathmandu Valley experienced large shaking, MMI intensity IX or greater, nine time since 1255. Subsequent studies, including comparative vulnerability studies of countries and cities in earthquake prone areas undertaken by the UN system (Reducing Disaster Risk: A Challenge for Development, UNDP/Bureau for Crisis Prevention and Recovery, 2004) revealed that Nepal is 11th position in the world in terms of relative vulnerability of the earthquake. Another study in 2000 puts Kathmandu Valley as performing worst among 21 cities around the world in terms of potential risk to earthquake measured in terms of potential death due to earthquake (Global Earthquake Safety Initiative (GESI), UNCRD/ GeoHazards International, 2001).

Nepal has 75 Districts and in Kathmandu Valley there are 3 districts Kathmandu, Lalitpur and Bhaktapur. Nepal has further 58 Municipalities mainly the headquarters of the districts but in Kathmandu valley in 3 Districts there are five municipalities namely Kathmandu Metropolitan city, Lalitpur sub Metropolitan city, Kritipur Municipality, Madhyapur Thimi Municipality and Bhaktapur Municipality.

Community surveys were done among the local communities in urban settlements of Kathmandu, and another separate survey was done among municipal officers and high level government officials by using standard survey questionnaire for each of the category developed under the program.

Risk perception of masons, contractors and builders was carried out in Lalitpur District in Lalitpur sub metropolitan city area and on the fringe area around the city with in the Lalitpur District. The masons interviewed were selected in field so some of them were also found trained by NSET and Lalitpur Sub-Metropolitan city in early days on Earthquake resistant construction Technology.

Risk perception of the Local Government officers were carried out, where 26 Municipal officers from 16 municipalities have taken part in the survey.

For the purpose of the central government officials risk perception survey was carried out among the high officials from Ministry of physical planning and works, Department of urban development and building Construction and Ministry of Local Development. All together 10 high level government officers had taken part in the survey.

All these survey was carried out to know the risk perception on Housing safety among the different layers of stakeholders and main purpose was to study gaps in knowledge to find out proper strategy for dissemination of earthquake resistant construction technology to different stakeholders.

2. METHODOLOGY OF THE SURVEY

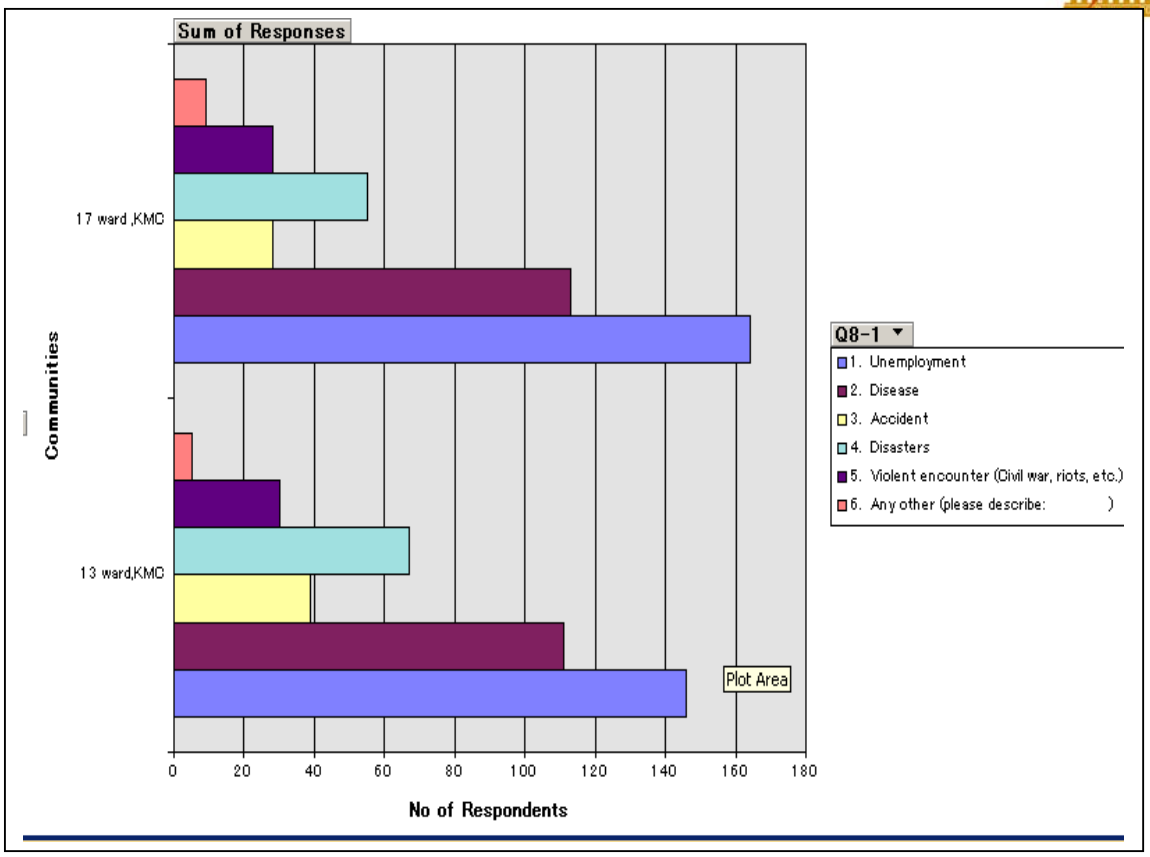
Different questionnaire were developed for different stakeholders. For the house hold survey on community of Kathmandu Metropolitan city ward 17 where community based disaster management work was carried out and ward no 13, where community based disaster management work was not carried out the survey questionnaire were in English as surveyors were mainly from university students and they were asking the questions in Nepali and house residents owners or tenants providing answers. Around 400 household from each community were surveyed.
For the survey of the Local government officers again separate questionnaire was there in English and it was filled up by themselves by a little explanation on questionnaire by NSET professionals. Likewise survey of the central level government officers were carried out also in separate questionnaire developed jointly by GRIPS and respective survey implemented country partners. It was filled up by officers themselves and later on the forms were collected.
For the survey of the local Masons the survey questionnaire was translated in Nepali language so that they themselves can read and fill out the forms. For the survey also masons and some university students were mobilized. All together 131 responders from the urban and rural part of Lalitpur Districts were surveyed. As Lalitpur is the most active district in building code implementation and more masons were trained jointly by NSET and Department of Housing and Building construction in collaboration with Lalitpur sub –Metropolitan city so some of the surveyed masons also falls on the trained category.

3. RESULTS OF THE SURVEY OF DIFFERENT STAKEHOLDERS

3.1 House Owners risk perception

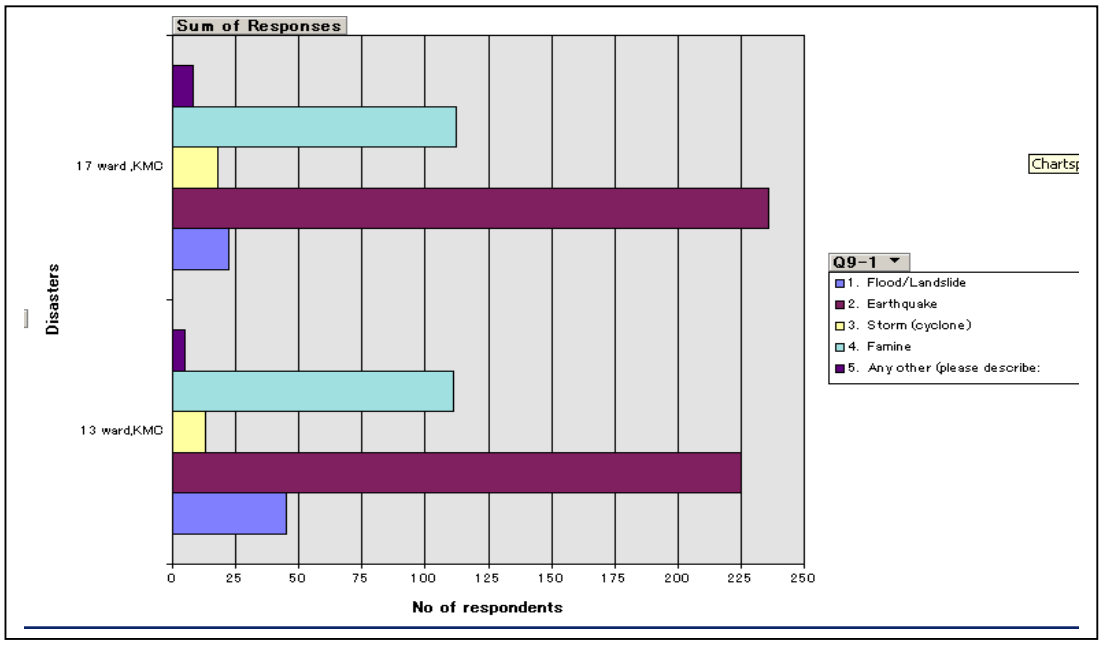
All together 35 questions on attributes and risk perception as well behavior of the respondents were put and some of the results are as found as below. As we have limitation on space here I will highlight on some of the issues on risk perception.

What will most severely affect your life: on this issue people are more concern about the employment and diseases then disasters but in both of the community the respondents mostly put disaster in 3rd position on the threat after unemployment and diseases. Here I have to mention that Nepal has no provision of health insurance even for the government employers and treatment in Nepal is expensive with comparison to their income in overall.



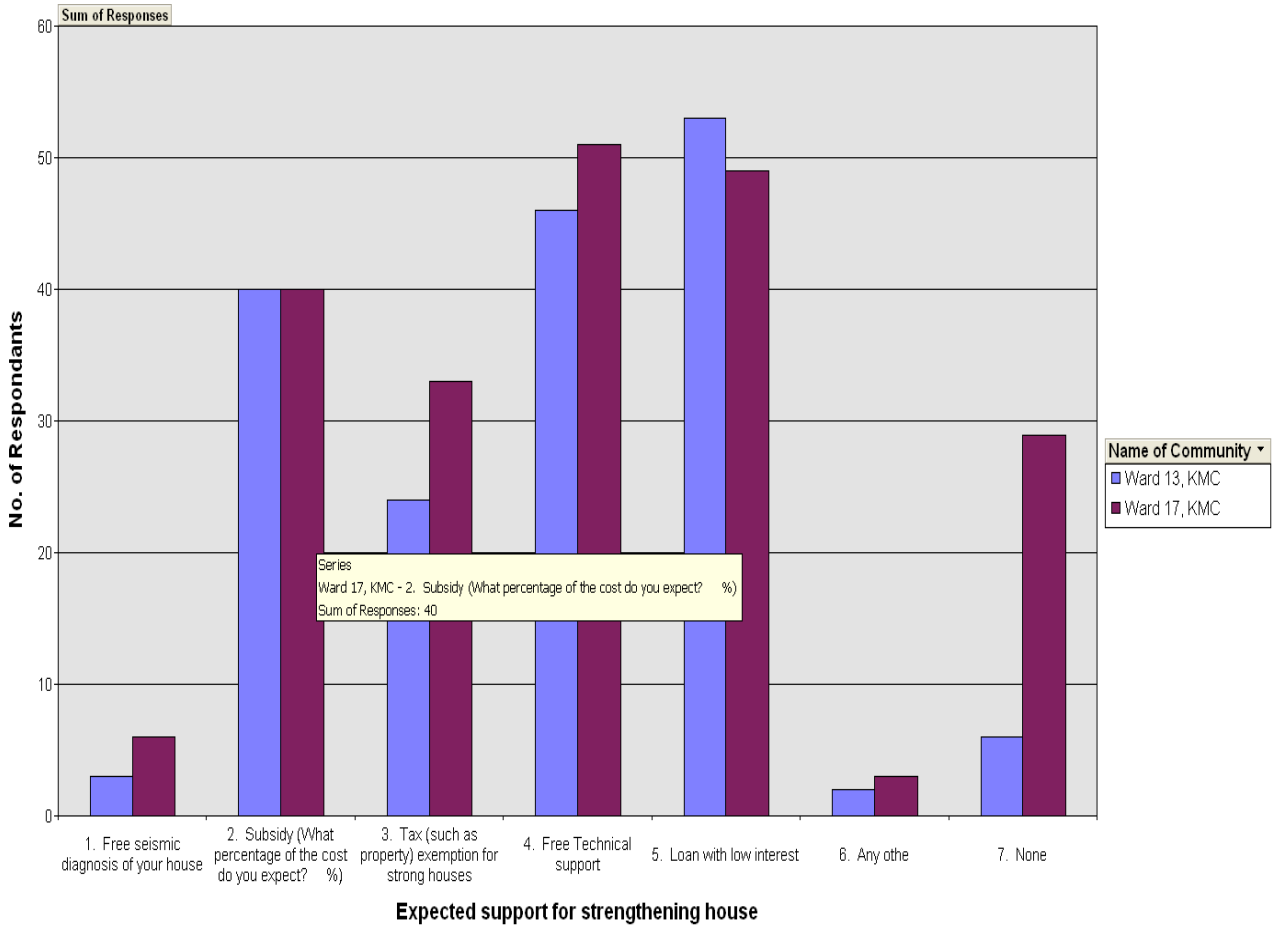
Kind of disaster which most affect life:

The respondents mostly felt that Earthquake is the most critical disaster and ward no -17 more respondents are concern about earthquake than any other disaster and likewise ward 13 people are also more concern about earthquake.



What type of support you expect to make your house Earthquake resistant?

When we talk about the peoples expectation on how it will be effective to support to community to make their houses strengthened, then people stressed on subsidy, tax exemption but much of respondent focused on free technical assistance and loan with lower interest rate.



3.2 Risk perception of Masons/ Builders and contractors

The survey questionnaire for masons / builders and contractors had 23 questions including interviewee details. Analysis and results of the some of the questionnaire are presented below.

What is the Mode of service you provide in building construction?

Most, 90 percent, of the respondents were found to provide service in labor contract. Very less, about 10 percent, respondents provided labor and material contract and build houses under contract. Among total respondents there were some that had more than one mode of services however, none of them were found to be involved in building houses and selling them.

What do you think the most contributing factor to loss of lives in case of earthquake?

Majority of respondents thought collapse of houses could be the major factor to loss of lives in case of earthquake. Almost half, 49 percent, of the respondents thought that people would be killed due to collapse of their own houses during an earthquake. Similarly, 18 percent thought that people would be killed in street by collapsing houses. There were 11 percent respondents who thought that lack of treatment could be a major

factor to loss of lives in case of earthquake.

How do you think a big earthquake will affect the houses you construct?

Even though many respondents thought that most people die due to collapse of house, only 8 percent respondents thought that there would be collapse of buildings they construct after a big earthquake. Majority, 41 percent, of the respondents thought that although there could be heavy damage to wall, beam and column but buildings they have constructed would not collapse after a big earthquake. While 29 percent thought that there could be light damage like cracks in wall, falling of parapet etc., 11 percent thought there could just be furniture fall, damage to light fixtures etc. There were another 11 percent who thought that there will not be any damage to the buildings they have constructed.
Looking at this result we can imagine that if you ask a question to someone about the quality of his work it is very difficult to answer that I am doing not good so many people say that the building constructed by them will not collapse where as we can find almost more than 80 % masons are not trained on earthquake resistant building construction.

What do you think the most critical component to make building withstand the earthquake?

Foundation is the most critical component to make building withstand the earthquake as identified by 84 percent of the respondents. Columns and beams were selected by 15 percent of the respondents as most critical components.

What is the main causative factor to make buildings vulnerable to earthquakes?

Main causative factor for building vulnerability as identified by most, 42 percent, was bad quality of material (brick, sand, cement etc.) followed by lack of awareness to homeowners identified by 19 percent of the respondents.

What is the most critical aspect of process in making earthquake resistant building?

Quality control and workmanship (curing, proper lying of the brick and mortar, concrete pouring etc.) was found to be the most critical aspects of process in making earthquake resistant building among respondents (40 percent). Design detailing, 26 percent, and site selection (22 percent) were the second and third critical aspects chosen. Other aspects (2 percent) include foundation as well as not applying materials in correct ways and selection of right place as well as use of correct materials.

What kind of measures do you take to make buildings strong against earthquakes?

Most of the respondents, 105 of them, thought providing good foundation could make buildings strong against earthquakes. Taking good care in connection between beam and columns (99 respondents), use of good quality materials (90 respondents) and provision of structural connection between buildings components (89 respondents) were other measures that were selected by most respondents.

Have you (and or your mason) ever taken any formal training on earthquake resistant construction?

Most of the responders (72 percent) had never taken any formal training on earthquake resistant construction. Some of the untrained masons are also working with trained masons so technology transfer process is there but still the demand of training is so high. In Nepal usually masons learn to work by working together with other masons as they do not have formal opportunity for the skill trainings. Practically they can learn from each other but theoretically they are mostly not aware about what they are doing so it is extremely necessary to have formal training so that they can analyze what they are doing for which reason.

3.3 Risk perception of Local Government Officials

Details of the Municipalities involved in the survey.

Municipality	City	Population	Area Sq.Km	Total Household	No. of Responders
Banepa	Banepa	16934	3.97	3200	1
Bhaktapur	Bhaktapur	80000	1.41	12000	3
Bharatpur	Bharatpur	110000	76	26000	2
Biratnagar SM	Biratnagar	166000	60	36000	2
Birgunj SM	Birgunj	147000	22.61	31250	1
Dhangadi	Dhangadi	68000	95	12000	1
Hetauda	Hetauda	90000	45.5	14271	2
Itahari	Itahari	41000	25	13000	1
Kathmandu M	Kathmandu	671000	52	105000	1
Kirtipur	Kirtipur	40839	14	9835	2
Lalitpur	Lalitpur	200000	15.6	40000	2
Madhyapur Thimi	Madhyapur Thimi	60000	11.47	9551	1
Mahendranagar	MahendraN	100000	196.4	15000	1
Pokhara SM	Pokhara	220000	55.54	37305	1
Tansen	Tansen	25000	23	4813	3
Tribhuwannagar	Ghorahi	53000	76.6	13000	2

SM = Sub Metropolitan City; M = Metropolitan City

Main Natural hazards identified in the municipalities

Majority of the respondents (40 percent) has identified earthquake as the major hazard followed by flood in their municipalities.

Most contributing underlying earthquake risk factor to your city

Vulnerable buildings and bad construction practices has been considered to be the most contributing underlying earthquake risk factor according to majority of the respondents (39 percent) followed by lack of emergency preparedness (23 percent) and lack of emergency preparedness system (23 percent).

Root cause of the vulnerability in building construction system

Lack of motivation to home owners for earthquake safe building construction (34 percent) and lack of building enforcement and information dissemination system (27 percent) were the major reasons for the root cause of vulnerability according to the responders.

Here we need to think that government officers believed that the problem for making building save not lies with the economic conditions , the most factors is to have access to practical techniques 15 % and lack of building law enforcement and information dissemination.

Composition of building construction typology in the city (approximate percentage)

RC framed building with brick wall is found in most of the relatively developed cities of the country. The existing stock of adobe or masonry is also considerable in cities but looking at the trend of building construction main focus on cities should be on Reinforced Concrete frame Buildings.

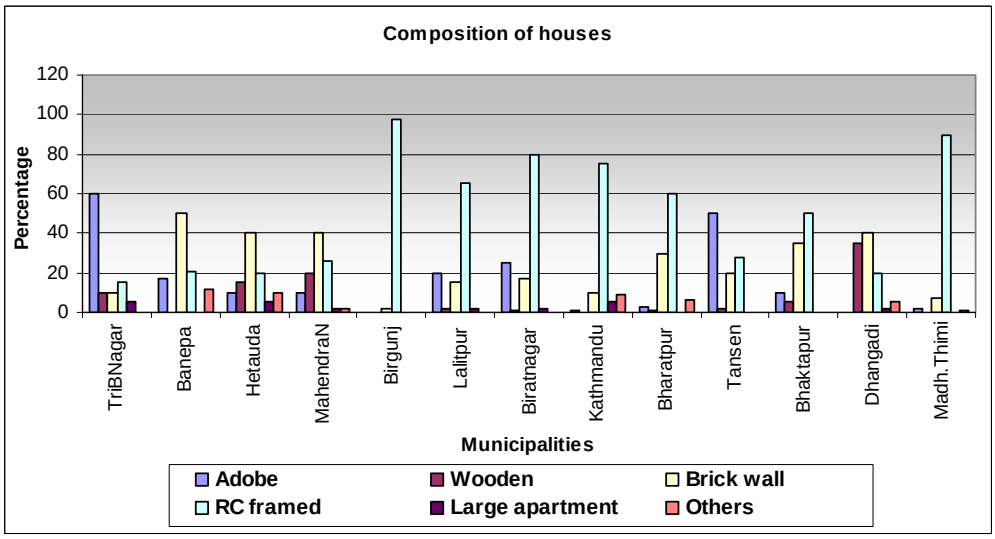


Figure: Composition of building construction typology in cities

Measures planned for future to increase the compliance

Increasing public awareness activities for building safety (35 percent) providing training to municipal staff (28 percent) were the most preferred measures planned for future.

Percentage of total budget of city that goes for building control system

Majority of the respondents (77 percent) highlighted that less than 5 percent of the total budget goes for building control system. None of the cities had 15 or more percent of total budget that goes for building control system.

Most important intervention that city government can make towards building safety of cities

Development and dissemination of guidelines to communities (35 percent) and strict enforcement of building code (34 percent) were the most important intervention that a city government can make towards building safety as understood by the city officials.

3.4 Risk Perception and Building Safety of Central Government Officers

The questionnaire for the Centre level Government officers was of subjective type so it was difficult to analyze but we have tried to summarize their views on the following paragraphs.

Do you think there is any immediate threat of earthquakes in your country looking at the country's history and recent past earthquakes?

Majority of the responders (80%) perceive the immediate threat (or within 10 years) of earthquake in Nepal

What are the immediate actions to be taken for effectiveness of building code implementation?

Majority of the respondents stressed on the need of public awareness and training and dissemination of building code at local level, some stressed on effective monitoring and remaining stressed on revision of law and makes the building code as a law.

In order to improve the building safety against earthquakes, what kinds of policies and activities do you think should be taken by the local governments?

Majority of the respondents stressed on the need of awareness and technical training, implementation of the existing codes and sufficient budget allocation by the local government.

In order to disseminate practical technologies for safer building, what measures do you think would be most effective?

More than 60% respondents say technical training to various stake holders for technology transfer and remaining 30% say the need of involvement of mass media and dissemination of reading materials (posters, pamphlets, photos)

CONCLUSION

Peoples are more concern about the unemployment and diseases and then only concern about the disasters, but while talking about the disaster more concern is on earthquake Hazard. It is found that almost many people now understand that safety is their concern and largely they are not willing to blame government and contractors rather willing to get help in terms of technical support , tax exemption for retrofitting of the house or providing loan with low interest rate to encourage them to make their houses safe.

The study shows that most of the masons and builders are responsible for building the houses in labor contract only and many of them 72 % have not received any formal training on earthquake resistant construction neither have any guideline to follow during construction. So masons / builders need more trainings and guideline for the proper improvement in the construction.

Looking at the result of the survey of local government officers, it is found that they have sufficient knowledge about the history of Nepal in terms of earthquake so no one says there will never be earthquake in Nepal. More than 80 % officers are worried about the anticipated impact and damage of the houses so they even convinced that root cause of vulnerability lies in the building construction and about 35% officers says motivation to home owners necessary and 27 % says lack of building code enforcement and information dissemination is the root cause and 15 % believes the risk can be reduced by providing access to practical techniques to home owners. While talking about the measures planned for the future 35% says about the increase of public awareness activities for building safety and 28 % says about the training to municipal staff but while talking about the budget allocation, more than 70 % Municipality have allocated budget less than 5% for all these activities although their earnings from the building permit is much more then they spent for building safety improvement.

From the survey result central government official's view of risk perception is found to be in high level. Almost all are agreed about the risk and need to work for the risk reduction activities. They are aware that risk reduction can be done by raising awareness and providing technical training to concern people.

In summary we found that risk perception is there but risk reduction is not in the priority business so we need to work together with Municipality further in Training, capacity building and risk assessment so that risk perception can be useful in action for risk reduction. Again for this purpose we need to develop materials for the target people.

REFERRENCES

1. UNDP. "A Global Report, Reducing Disaster Risk, A Challenge for Development." 2004.
2. GESI. "Global Earthquake Safety Initiative, Pilot Project, Final report." Geo Hazards International and United Nations Center for Regional Development, 2001.
3. NSET. "Kathmandu Valley Earthquake Risk Management Action Plan." NSET and GHI, 1999.
4. NSET- Final report on Seismic Risk perception of different Stakeholders of Nepal, 2007.