A HIERARCHICAL SYSTEM FOR TRAINING AND AWARENESS RAISING AT GRASS ROOTS LEVEL: EXPERIENCES OF NSET FROM EARTHQUAKE-RESISTANT HOUSING RECONSTRUCTION IN PAKISTAN

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ABSTRACT:

It is a known fact that heavy loss of life and properties during earthquakes is mainly due to weak buildings and lack of preparedness resulting from the low awareness level and lack of sufficient capacity to incorporate earthquake resistance into the construction practices. Although there exists tremendous knowledge on engineering aspects of earthquake safer construction in many academic and research institutions even in developing countries, but the basic knowledge and concepts of earthquake-resistant construction have not been reaching to the common people where such knowledge requires most; not reaching to the local masons, petty contractors, self-builders who are predominant constructors in the developing world and who construct more than 80% of the residential dwellings. The houses where common people live are still being constructed without consideration of earthquake safety. This situation, in one hand requires significant efforts to raise awareness of common people as well as of the authorities and policy/decision makers; on the other hand needs lots of education and trainings for enhancing capacities for safer construction. Experiences have shown that a continuous system for awareness raising and capacity building is required to systematically address the need.

Above concepts have been reflected in awareness raising and training programs of the National Society for Earthquake Technology - Nepal (NSET) and has been successfully implemented in Nepal and have also been utilized intensively in rural housing reconstruction in Pakistan after the massive disaster due to 8 October 2005 earthquake. Various awareness and capacity building programs were implemented with many national, international, donor and UN agencies, namely with UNDP Pakistan, UN Habitat and USAID/OFDA. A set of 16 different courses were developed, and hierarchy of training programs were implemented for developing cadre of instructors from which a total of 28 master instructors were developed. Total of more than 70 different training programs were conducted in around one and half years period and more than 4,000 different audiences were trained. The program was successful in positively influencing the construction of around 600,000 rural houses of Pakistan and demonstrated a high replication potential in other parts of the region. This paper describes philosophical background, approaches, methodology, activities, outcomes and lessons learned in detail.

KEYWORDS:

Awareness raising, capacity building, training, earthquake-resistant construction, common people, instructors

1. PHILOSOPHICAL BACKGROUND

1.1. Existing Building Production Mechanism

The predominant building production mechanism in Nepal and other developing countries is owner-built construction which is mostly non-engineered. Figure 1 shows the situation of building production system in Kathmandu Valley, the capital city of Nepal, which clearly shows more than 80% of the residential buildings in

Kathmandu Valley are being built by informal sector mostly by untrained leader masons, petting contractors and sometimes owners themselves. The situation in other developing countries is also similar to that of Nepal.

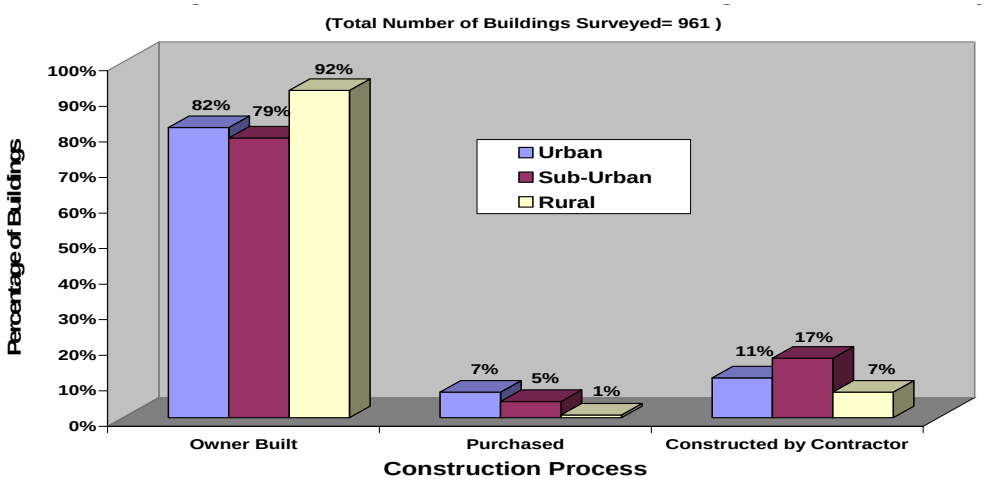


Figure 1: Building Construction Process for Residential Buildings in Kathmandu Valley

These owner-built houses are mostly constructed by the owners at the guidance and with the involvement of a head-mason or a local petty contractor or a carpenter who lacks any modern knowledge on earthquake resistant construction. Traditional construction materials such as timber, stone rubble or brick (fired or un-burnt) and mud as mortar are used. These are usually rural constructions. However, such constructions are seen also in the poorer part of a city, or in the city suburban areas. These owner-built houses are normally constructed without any proper engineering input in terms of strength and earthquake-resistance capacity; therefore most of these houses are non-engineered. Further, there is an increase in the prevalence of frame-structures nowadays, but unfortunately, many of them are again constructed without the input from qualified engineers, making them potentially highly vulnerable to earthquakes.

1.2. Existing Practice of Training Manpower

Although there are many engineering institutions and universities in the region, where tremendous knowledge on engineering aspects of earthquake safe construction exists, the basics of earthquake-resistant construction have not been taught with proper emphasis so that the basic concepts of safety reaches to the common people, to the main construction stakeholders like masons, petty contractors, owner-builders through the skilled engineering professionals. The design and construction aspects of simple masonry or timber houses, local construction technologies and traditional wisdom are not taught in such institutions whereas the design and construction of multi storied modern high-rise buildings are taught, but the proportion of such construction is very little. Most of the developing countries have been spending significant amount of money for training qualified engineers and technical professionals; unfortunately these qualified technical professionals have access to only less than 20% of the engineered buildings, whereas more than 80% of the buildings are non-engineered without any inputs from these technical professionals and constructed by local masons or petty contractors. However, very little amount of money is being spent for training or capacity upgrading of these local masons and petty contractors who construct more than 80% of the total buildings.

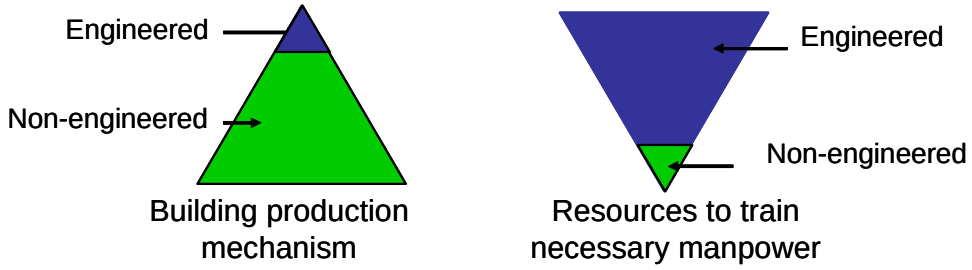


Figure 2: Resources distribution in comparison to construction mechanism

The ratio of the number of buildings with different construction mechanism and efforts to prepare necessary manpower and documents can be compared with these two inverted triangles (Figure 2). The first triangle shows the ratio of buildings by different construction mechanism and second one the existing resources allocation. For real improvement in the existing earthquake scenario, the picture should be changed by adopting radical methods.

It has been repeatedly demonstrated that heavy loss of life and properties during earthquakes is mainly due to weak buildings resulting from low level of earthquake awareness among common people and the authorities and lack of sufficient capacity to incorporate earthquake resistance into the construction practices. In most of the developing countries, not only common people even educated people are unaware that potential death and injury and heavy loss of properties due to earthquakes can be reduced significantly by constructing the houses in earthquake-resistant manner and which does not require significant amount of additional cost.

This situation, in one hand requires significant efforts to raise awareness of the common people as well as of the authorities and policy/decision makers; on the other hand needs lots of education and trainings for producing capable persons to make earthquake-resistant houses in the communities. Experiences have shown that raised awareness creates demand for safer construction and there should be a proper system to fulfill such demands by having sufficient number of capable persons for constructing earthquake-resistant houses. Unless people and the authorities become aware on the fact that large earthquakes even not very frequent in the region, once they occur they result in significant loss of life and property and worsen the life of common people. It becomes very difficult for common people to rise from the rubbles after the massive earthquake and requires many years to recover completely from such destruction. Therefore, There is a huge need of awareness and trainings and without comprehensive approach and methodology it can't be done, doing just few awareness programs and training programs is not sufficient, needs thinking in broader perspective Therefore, a system for awareness raising and capacity building should be in place.

2. THE GAP TO BE ADDRESSED

Each year a significant number of private residential houses are built at the grass roots level in any developing country; and such number significantly increases during post-disaster reconstruction and rehabilitation stage. The number of houses being built is usually several hundred thousands. If there is a regular system for making common people aware on earthquake safer construction and also a system for making local masons and construction workforce capable of constructing houses in earthquake-resistant manner, larger proportion of residential houses can be made earthquake safer within a short period of time which also helps in creating a culture of prevention and safety among the general people. However, the number of common people to be aware is usually several hundred thousands and the number of masons/ construction work force to be trained is several thousands; whereas the number of capable technical persons / professionals who are actually at the field to aware people and to train masons is significantly less sometimes may be less than hundreds.

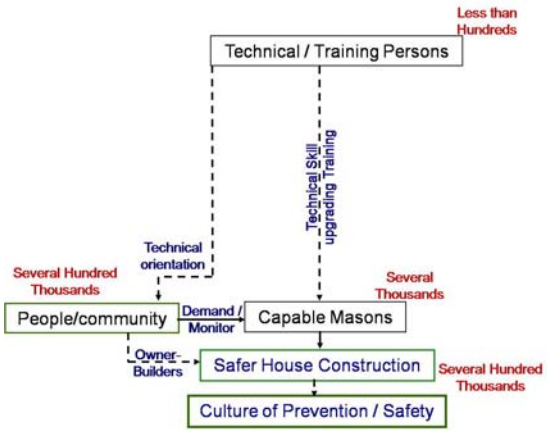


Figure 3: Conceptual Framework of Need vs. Available Resources

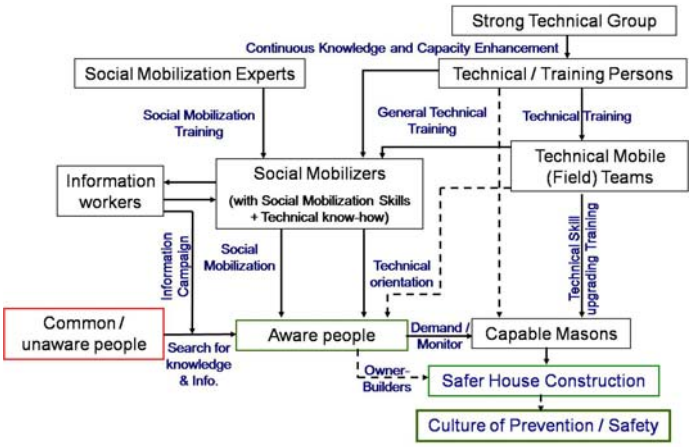


Figure 4: Alternative conceptual approach for awareness and capacity building

Hence, there is a huge gap between the needs of awareness-raising and capacity building at the grass roots and the available professionals for assisting in such awareness-raising and capacity building. Figure 3 reflects the conceptual framework of awareness and capacity building and the gap.

In such context, there should be an alternative approach for awareness-raising of the people and capacity building of the local construction work force. An alternate approach which was consolidated by NSET based on the experiences of working in Nepal and Pakistan is reflected in Figure 4. This alternative approach suggests that a layer of different field training personnel (information workers, social mobilizers and technical mobile field teams) need to be developed to fill the gap with sufficient knowledge and skills on training to people and the construction work force. The group of information workers and social mobilizers will help in creating/increasing awareness of people and motivate them for demanding earthquake-resistant construction; whereas the groups of technical mobile field teams train local mason, petty contractors, and carpenters to construction houses in earthquake-resistant manner. Such field teams need backup and necessary trainings from more qualified and experienced professionals.

In this way, this alternative approach requires systematic training of different target groups at different levels, most importantly the training of trainers. Hence, NSET has proposed training of different target groups which is shown in Figure 5:

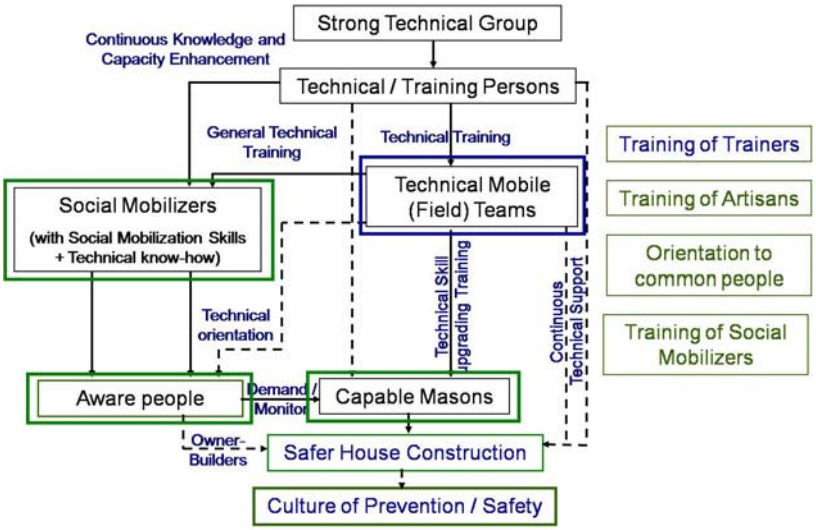


Figure 5: Need of training different target groups

3. AWARENESS AND TRAINING SYSTEM ADOPTED BY NSET

Based on the above concepts, NSET developed and implemented a suit of different training courses to fulfill the huge demand of safer housing reconstruction in Pakistan. The Government of Pakistan adopted in-situ and owner-driven housing reconstruction policy for the reconstruction of around 600,000 rural houses, and for which obviously there was a huge need of technical support to be provided for the house-owners to construct earthquake-safer houses. This huge task of providing technical support to around 600,000 was possible only through following the hierarchy of training and capacity building system. Realizing this systematic approach of NSET, the Earthquake Reconstruction and Rehabilitation Authority (ERRA) of the Government of Pakistan informally assigned the role of leading the training and capacity building process required for the rural housing reconstruction program to NSET. During the program, NSET implemented a hierarchy of different training programs for awareness-raising of the common people, social motivators and policy/decision makers and also for the development of a cadre of master instructors and instructors for continuation of such programs in a sustainable manner. About 16 different courses were developed, adapted to suit the condition and need. A total

of around 4,000 number of people were directly trained by NSET trainers from around 66 number of different training programs through a network on 12 Housing Reconstruction Centers (HRCs) scattered around the entire earthquake affected areas of Pakistan, 850 number of instructors and 28 number of master instructors were developed in the one and half year duration from different NGOs in different earthquake affected areas following the same hierarchy and concept of the training (Table 1).

During the whole process of training and capacity building, NSET emphasized on developing instructors and master instructors since the success of this alternative approach was highly dependent on the number, capacity and delivery of the instructors/trainers to train field professionals and through them to provide technical assistance to the people. Following sections briefly describe the strategy, methodology, outcomes, impact and lessons of the implementation of such hierarchical system of training and awareness-raising.

This is an overall framework and system for developing instructors and master instructors for enhancing capacities for earthquake-resistant construction of non-engineered buildings in developing countries. The instructors developed with this process will be able to train technical persons, construction workers, community workers, house-owners and policy/decision makers: all main actors of safer building construction. Further, the process is intended to help in creating a cadre of experts on earthquake-resistant construction technology. This system can be adopted for use in post-earthquake rehabilitation and reconstruction which demands an accelerated process of capacity building for earthquake-resistant reconstruction in a mass-scale. It can also be adopted for enhancing capacities for multi hazard-resistant building construction.

3.1. Approaches

Main strategy and approach are:

1. The main focus is to assist in capacity enhancement of local technical professionals on safer construction practices,
2. Help in long-term sustainability of the training process and optimize the residual effect,
3. Technical solutions and technologies for earthquake–resistant construction are guided by following main principles:
    a. Promotion of local materials and local construction technologies, with due respect to the positive elements of traditional wisdom in earthquake–resistant construction
    b. Promotion of local solutions to specific local problems
    c. Emphasis on hands-on and on-the-job trainings
4. The training approach is:
    a. Working and learning together – in close cooperation with local people and organizations
    b. Ensuring the “Training – Implementation – Monitoring – Evaluation – Strengthening” is a continuous process

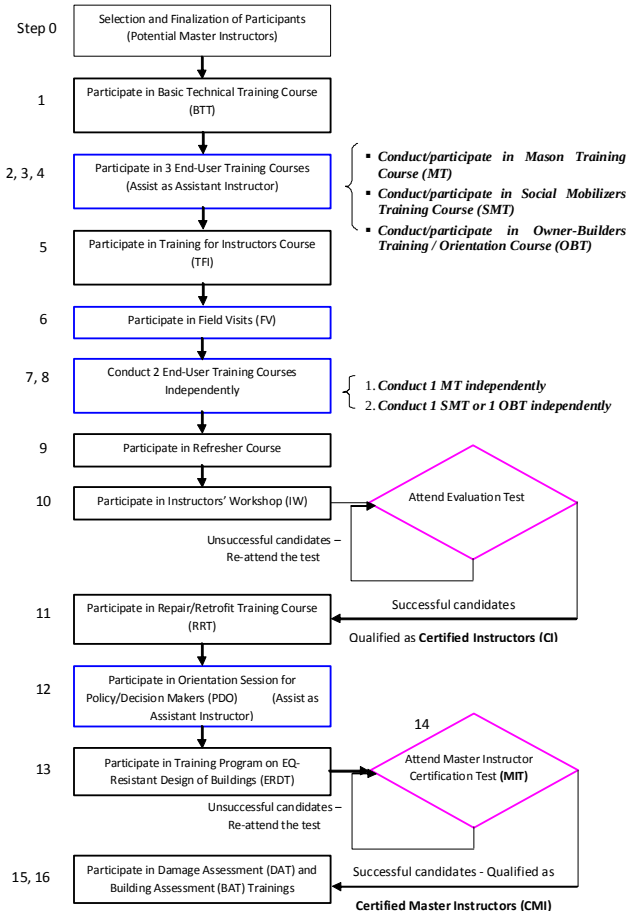
3.2. Objectives

The main objectives of the hierarchical training and awareness system are:

1. To develop/create a cadre of master instructors on earthquake resistant construction technology
2. To help develop institutional system for instructor development on earthquake resistant construction technology

3.3. Methodology

Following hierarchy of different training courses is followed:



3.4. Different Training Courses and Potential Participants

The Master instructor/ Instructor development process would require conduction of several training programs: some training of potential instructors (TOT) and some end-user trainings (EUT) for masons, community mobilizers, common people and policy / decision makers. The qualifications of potential participants for various training courses are as summarized as below.

S. No.	Training Course for Instructors (TOT)	Potential participants (Potential Instructors / Master Instructors)
1.	Basic Technical Training Course (BTT)	Civil engineers (with Bachelor's Degree qualification), Architects (Graduate or under graduate (Bachelor), Sub-engineers (with civil and architecture background)
2.	Training for Instructors Course (TFI)	Civil engineers, Architects and Sub-engineers
3.	Instructors' Workshop (IW)	Civil engineers, Architects and Sub-engineers
4.	Training Course on Repair and Retrofit (RR)	Civil engineers, Architects and Sub-engineers
5.	Training Course on Earthquake-Resistant Design (ERDT)	Civil engineers, Architects and Sub-engineers
6.	Damage Assessment Training Course (DAT)	Civil engineers, Architects and Sub-engineers
7.	Building Vulnerability Training Course (BAT)	Civil engineers, Architects and Sub-engineers

S. No.	End-User Training Course (EUT)	Potential participants
1	Mason Training Course (MT)	Local artisans Masons (brick-layers, stone layers), carpenters, bar-benders
2	Social Mobilizers Training Course (SMT)	Community volunteers, community motivators, social mobilizers, social organizers and any other community workers
3	Owner-Builder Training/Orientation Course (OBT)	Potential house-owner who is construction a new house, women, elderly persons and other common layperson
4	Orientation Sessions for Policy / Decision Makers (PDO)	Policy and decision makers at different levels which may consist – village and district level local authority members, Government Officials, Parliamentarians etc.

3.5. Scope of Training Courses

The training courses focus on earthquake safer construction of mostly non-engineered houses made with stone, brick and block in mud mortar or cement mortar and also try to cover the RCC constructions. These are the common building types in the rural and sub-urban areas of the region. The courses are mainly for enhancing the seismic safety of residential houses and do not cover the public buildings like of high importance such as schools, health centers etc.

4. IMPACTS OF THE AWARENESS AND TRAINING SYSTEM

The most important impact of the hierarchical system of awareness and training conceptualized and implemented by NSET is that it could positively influence the "Build Back Better" earthquake-resistant housing reconstruction of Pakistan by creating a significant number of instructor, master instructors and capable construction work force. Following table highlights the achievements:

Table 1: Achievements form training and awareness programs conducted directly by NSET during period Nov. 2005 – May 2007 (under the awareness and training system)

Description	Achievement (No. of Training programs, trained people)
Total number of different training programs conducted	66
Total number of professionals and people trained	2,580
Total number of instructors/trainers developed	850
Total number of master instructors developed	28
Total number of masons trained	700
Total number of other beneficiaries	1,030

The number of people and construction professionals trained by instructors and master instructors developed is significantly high and is not included here.

Other important impacts of the system are:

- Advocacy and ground work for driving Pakistani authorities for formulation of owner-driven and in-situ reconstruction policy of the government of Pakistan
- Need, concept, methodology and process for technical assistance for housing reconstruction established
- Instructor development process, and concept and possibility of mason training on earthquake-resistant construction established
- Compliance (full or part) of new construction to the earthquake-resistant provisions
- Concept of possibility of seismic retrofitting of earthquake damaged house is established
- The replication process has been started in Nepal after the success in Pakistan

5. LESSONS LEARNED

Main lessons of the program implementation are:

- Reconstruction process starts right at the early recovery phase after the disaster and hence the preparation and support for reconstruction should start in parallel with the relief and recovery phase; it is not necessary to wait until the end of the relief and recovery phase. People start reconstructing their houses soon after they stood from the rubble of the disaster, people usually don't look at others for rebuilding their shelters. It will always be better to influence the reconstruction immediately after when the memories of the impact of disaster are still fresh in the minds of the people and in general it is very easy to motivate them for the safer construction.
- Good policy environment is needed to support/enforce safer construction practice as well as the proper system of awareness raising and capacity building to support the proper implementation of good policies. Having good policy only is not sufficient; need good ground for implementation.
- Capacity building and instructor development is a long term process. The hierarchical system should be backed by proper institutional arrangements (institutional mechanism) and need commitments from all concerned
- Maintaining the quality and standards of training is extremely important and selection of proper participants is the key to success. It should be done based on criteria.

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