

Post Earthquake Reconstruction in Nepal: Its Communal Impacts and Essence of Socio-Technical Assistance

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ABSTRACT

Disasters, either man-made or natural, disrupt the normalcy, as they result in huge losses of lives and structures which can't be arbitrated in monetary terms. In 2015, Nepal was rattled by massive Gorkha Earthquake, collapsing and damaging nearly millions of infrastructures and carnage of about ten-thousands of population. Private housing was one of the prominent sectors which had to face severe loss, comprising major fragment of the reconstruction. The housing restoration has been expediting forward with adoption of owner driven approach for its high acceptability and sustainability, through learnings from other countries. Noteworthy deviations can be seen in greater quantity in the construction patterns and awareness insights in the wake of quake than that used to be in practice before. The major objectives of the paper are to determine the communal impacts; mainly deviations in vernacular architecture, settlement patterns and changes in perception as well as requirements and the quintessence of socio-technical facilitations, the positive influences they can create to intensify community engagement in addition to enhance capacity and reach the aspiring desires. With this in mind, the aid of data adhering the utility of reconstructed house in selected municipal units of Dolakha, Dhading, Nuwakot and Kathmandu as well as the literatures regarding similar practices will be taken in order to unveil the probable communal impacts that may ensue in the post disaster events and the affirmative efforts for harmonization of the raised crucial mandate, its fulfillment through capacity enhancement and achievements institutionalization that can be made by combination of socio technical assistance.

KEYWORDS

Gorkha Earthquake, Reconstruction, Owner Driven Approach, Societal Impacts, Socio-Technical Assistance.

1. INTRODUCTION

In every few generations, Nepal has been experiencing major earthquakes, resulting in devastating physical and human losses. Dating back from 1255 there have been multiple huge earthquakes, almost in every centuries in which thousands have lost their life and there has been huge forfeiture in terms of economy (Rana B.S.J, *The Great Earthquake in Nepal, 1934*). Moreover, the Gorkha Earthquake of

April 25, 2015 and its aftershocks claimed more than 8790 lives as well as shattered infrastructures worth billions. Among other sectors private housing was one of prominent sectors that shared the major fragment of destruction, with 4, 98,852 houses damaged completely and other 2, 56,697 partially, most of which belonged to rural terrains of the country. **(Nepal Earthquake 2015: Post Disaster Recovery Framework)**. However, such huge damage over the rural buildings (*low strength masonry built over mud mortar*) was actually never anticipated. The buildings neither had to take permission from municipal levels for construction nor were they compliant with the national building code, which resulted in such a devastating scenario. Moreover, the country has expedited itself into the gigantic campaign of reconstruction being overseen by legitimate agency called National Reconstruction Authority (N.R.A). As per depicted by datasets, 69% of the total enrolled households have started construction while 38% have completed their construction **(National Reconstruction Authority, Datasets (Retrieved 28th Oct 2018))**.

In this regard, various community based national and international organizations are facilitating the reconstruction process in assorted sectors based upon the needs of the community which in the end will result in the resiliency. Various programs related to livelihood, agricultural, health and energy are also accompanying the reconstruction which are being run by different organizations to contribute to the sectors affected by the quake. It has been seen that disasters affected different communities in varied way among which rural area more vulnerable. Nepal is a country with prevalence of rural areas and almost 83% of the total population resides there. As a source of livelihood, agriculture is the major occupation in the region **(Epstein et al., 2018; Jones et al., 2018)**. Despite the fact that housing reconstruction completely seems to be a technical issue, there are various other sectors like economic, social and cross cutting, which affect the pace of rebuilding. Past experiences from recovery show that notions of people must be realized and there should be community participation as well as their engagement in income generation activities in order to proceed restoration process in a safer way **(Guidance Note on Recovery)**. The Gorkha quake in its wake has left many impacts in the community bringing changes in the multiple dimensions. There has been changes in the physical proportions of buildings, the households have split into multiple fragments and people are seeking dynamic assistance which can support different facades of life. Nevertheless the fact that ultimate goal is to rebuild in a resilient way, the path to recovery however needs to be embrace the notions of people and understand their core needs in order to sustain the achievements. Keeping this in mind, a socio-technical approach provides a well guidance and engages the community to make them essence of resilient building practice. Moreover, this method is based on principle that a well aware community with enhanced capacity can only make assenting exertion towards making the society safe. This brings the essence of self-realization and initiation which in longer term is believed to institutionalize the achievements. . Whilst, focusing on the core housing reconstruction, provision of technical/financial or both type of assistance is in practice by organizations who are working in various earthquake affected districts. A good socio-tech assistance will aid in linking all these efforts being made by various stakeholders that will not only contribute disaster resilient houses in present but in longer term will also help to sustain the achievements as a good investment against future hazards.

2. METHODOLOGIES

The segments below are derived from series of survey conducted from 2017 to 2018 in the course of program implementation. Two different types of survey namely Reconstruction Status Survey and Utilization of Rebuilt dwellings. The detail methodology adopted in the course of both surveys has been developed which is illustrated below:

2.1 Utilization of Rebuilt dwellings

A cross sectional survey was done based upon different geographical locations among the total beneficiaries residing in chosen municipal units of four districts namely Dhading, Dolakha, Nuwakot and Kathmandu. Among the total beneficiaries sample size of 408(>383) was selected who had rebuilt their homes in the aftermath of earthquake. All the respondents belonged to age group of above 20. The households were chosen through the random sampling. A set of questionnaires comprising the research

hypothesis, indicators covered and the demographic aspects of targeted community were developed for surveying. The survey was conducted with the help of enumerators who carried out through in person contact.

2.2 Reconstruction Status Survey

The Reconstruction Status Survey was a simple random sampling based on different geographical location (coverage VDC/Municipality). The survey was a cross-sectional study design. Among total number of coverage beneficiaries 264 sample respondents were selected for the survey among the coverage districts where NSET is implementing the post reconstruction technical assistance program. Sample respondents were selected from the different geographical location, ethnicity gender and age-group. The earthquake victims, social activists and local masons of the program territory were the respondents of this survey.

In both surveys the sample size was estimated using following set of equation:

$$n = \frac{NZ^2P(1-P)}{(N-1)e^2 + Z^2P(1-P)}$$

Where,

e = Allowable error (5%), Z = Level of significance (5% level of significance)

N = Total number of households.

n = Sample respondent, P = Probability (0.5)

$$\begin{aligned} & \text{Percentage of sample respondent in each VDC/Municipality} \\ &= \frac{\text{Total households in each VDC/Municipality}}{\text{Total households in the NSET's coverage area}} \end{aligned}$$

Target sample in each VDC/Municipality. = Total Sample size in three district × percentage of household covered in each VDC/Municipality.

The SPSS v20 software was used in the analysis part.

2.3 Case Study of NSET's Baliyo Ghar Program

This paper studies the approaches and strategies used by Baliyo Ghar “Strong House” Program being implemented by the National Society for Earthquake Technology Nepal. The program is currently being implemented in Dhading, Dolakha, Nuwakot and Kathmandu districts and is facilitating the post-earthquake housing reconstruction in Nepal through socio-technical facilitation at different levels. The paper studies the essence of the different components of socio-technical assistance implied by the program in its working areas and the impacts achieved during the implementation of the program through the study of progress and compliance of reconstructed buildings.

3. RESULTS AND DISCUSSION

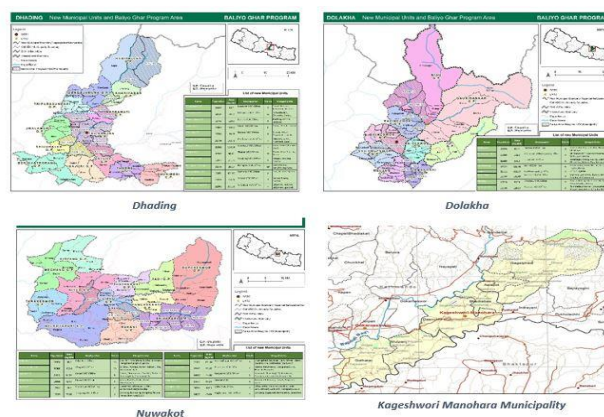


Figure 1. Administrative Maps of Dhading, Dolakha, Kageshwori Manohara Municipality and Nuwakot (Clockwise from Top Left)

The survey results in one part were able to light upon the probable communal impacts of earthquake whereas in the other dimension were providing the probable way forward towards how socio-technical assistance in reconstruction can leap the community towards making it resilient. Whilst the initial results of reconstruction Status Survey and Utilization of Reconstruction delve the information on the socio-economic dimension and impacts the community had to face in the aftermath of disaster and what their needs were. Whereas, the results of Building Compliance survey depict information on how the perception of community has changed regarding the incorporation of seismic resistant materials by utilizing the available resources. Besides, the core multitier strategical approach made by program will be serving the discussion part to explore how it deals with multi dimensions of society. In addition, the comparison in progresses will be made with alike reconstruction projects working in the reconstruction platform in post-disaster rebuilding.

Communal Impacts of Post Disaster Reconstruction

Table 1. Comparison of building typology before and after the 2015 Gorkha Earthquake

S.N.	Building Typology	Pre-Earthquake	Post-Earthquake
1	Stone in Mud Mortar SMM)	96.6%	62.3%
2	Stone in Cement Mortar (SMC)	0.5%	1.7%
3	Brick in Mud Mortar (BMM)	2%	2.2%
4	Brick in Cement Mortar BMC)	0.2%	22.8%
5	Reinforced Cement Concrete (RCC)	0.5%	9.8%
6	Others	0.2%	0.5%

The table above illustrates the alternation of building construction approaches in the aftermath of earthquake. As the earthquake had badly shattered the rural buildings dominated with low strength masonry in mud mortar, such buildings had to share major fragment of the damage. Clearly, the figure indicates that previously before the earthquake Stone in Mud Mortar buildings were prevalent type of buildings that used to be constructed. However, in the wake of earthquake such building typologies had to face severe damage causing high number of casualties. The survey data depict that the construction practice of SMM buildings have fallen by more than 30%. Moreover, trend has been such that there has been significant increase in construction of Brick in Cement Mortar and RCC buildings due to influence of modern technologies. Clearly, the BMC buildings have exacerbated by multiple folds i.e. by 22.6% and RCC buildings have increased by 9.3%. However, there is no significant change in other building typologies as they are not much feasible from the cost and materials perspective. Having said that, this shows one of the huge impacts of earthquake in which mindset of people have shifted such that they believe more in modern technologies rather than using the prior construction materials.

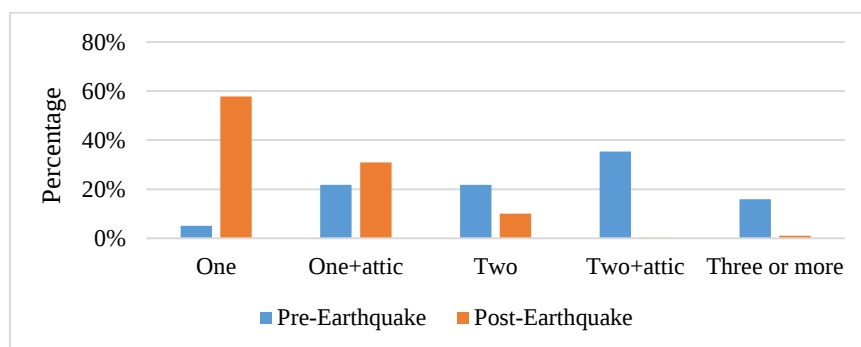


Figure 2. Comparison of dimensions (No. of floors) of houses before and after the 2015 Gorkha Earthquake

Interestingly, while looking over the tendency of floors, we can see there has been significant increase in the number of buildings with a single floor and the ones with attic. Conversely, one can clearly see that buildings with two floors or two floors and attic were the prevalent ones to be constructed prior to the earthquake. The reason behind the amplification in construction of low rise buildings is due to the limitations set by guidelines in post-disaster reconstruction and the cost parameters that increase with rise in storey numbers. Moreover, the concept that has been developed among the beneficiaries such that the taller houses had to bear much damage in the tremor has also guided them towards constructing limited storey buildings. Nevertheless, the decrease in storey height has contributed in safer construction practices, the deficient number of storey however questions whether they are currently meeting the demands of people or not, which ultimately queries the resiliency which we are thriving for.

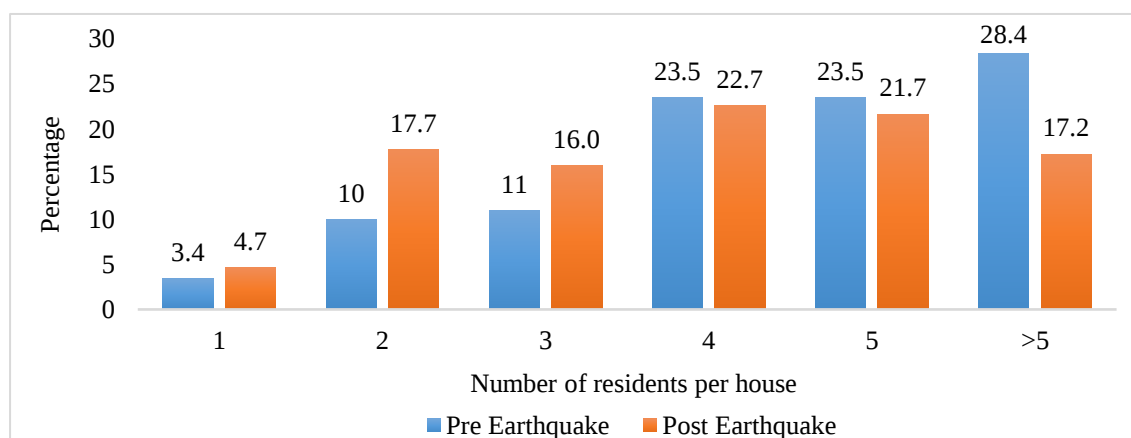


Figure 3. Percentage of houses with different number of residents per house before and after 2015 Gorkha Earthquake

In addition to change in the construction pattern of buildings, the splitting of families has also been seen in the post rebuilding scenario. The chart above illustrates that prior to the Gorkha Earthquake normally households with five and more than five members in each family was a prevalent type of occupancy, which indicates the culture of joint family system. However, in the aftermath of the quake, we clearly see that the tendency has shifted towards splitting of family members with two and three members per family in frontlines. Interestingly, this is the scenario to be looked upon and can be regarded as one of the major socio-economic shifting effects of the disaster. There are several reasons behind this splitting and there are pros and cons of it. One of the major reasons behind such splitting is directly linked with the shrinkage in physical dimensions of the building. There has been significant decrease in the storey heights, coverage area of buildings and the number of rooms. As per limited by the construction guidelines for safety of the occupants, people are bound to construct houses which however fails to meet the actual need. As a result, the family have to split in order to get shelter. Moreover, the providing of the subsidy to even separated/splitted households under the different circumstances after disaster has brought the negative tendency as more the number of heads more amount of subsidy can be accumulated to construct a new house. This twisting mechanism is an undesirable way has increased the number of beneficiaries which is still continuing now. In addition, the relocation and internal migrations are also some other additional factors which have supplemented in the splitting trend of families.

Communal Expectations and Desire in Post-Earthquake Reconstruction

When surface observation may seem housing reconstruction to be a technical issue as it deals with seismic resilient construction, there are various dimensions to be pondered upon while running such post disaster constructions. Nevertheless, housing sector was one of the major damage facing sectors, there are various other units like economic, social and cross cutting, which also comprise more than half of the losses. Moreover, being able to address all these all sectors rightly will only allow the housing reconstruction to expedite in a better way. In order to better understand all these matters that were raised

by beneficiaries in the wake of the earthquake, the results depicted by the Reconstruction Status Survey helped to figure them out, which are illustrated in Fig 4.

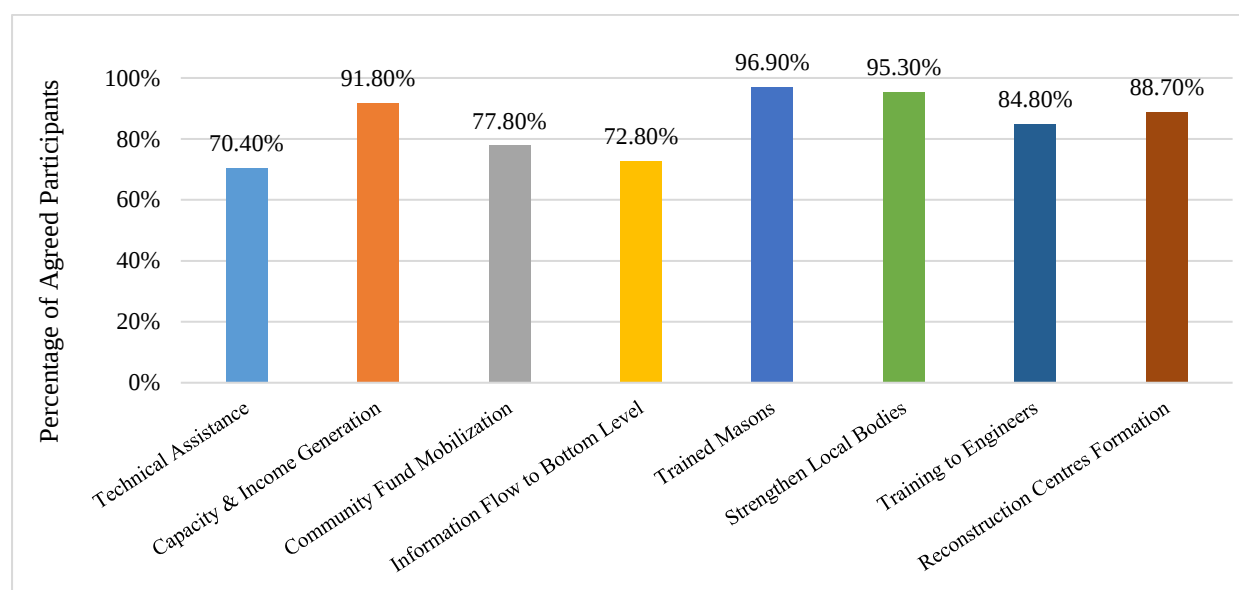


Figure 4. Percentage of respondents that agree to a specific necessity to expedite the reconstruction process

The figure demonstrates the essence of activities that need to be addressed properly in order to intensify the rate of reconstruction in a safer way. Clearly, it indicates that a reconstruction to be advance in a proper way various circumstances need to be dealt with care. Additionally social, livelihood and physical structures sectors also have linkages in the restoration. As depicted, the presence of good technical assistance programs along with trained technical workforce can aid in easing the technical complications. An ease in the technical complications can intensify the compliance rate and help the beneficiaries to obtain the subsidy. Moreover, while considering the livelihood aspects engaging the people in income generation activities like agricultures, horticultures and other alternative sources of income can facilitate their livelihood which will safeguard the sustainability. This will act as a source of income to earn their daily lives as well as save a part of its expense in construction of the building itself and other necessary works.

Additionally, mobilizing the community members themselves in reconstruction will increase the level of acceptance & affection which in longer term will make them realize their potentials to cope with the disastrous situations. This is very much vital because without engaging the community members themselves they will never realize what their potential is and will always be dependent upon the external area to get uplifted. Likewise, dissemination of information to bottom level plays a vital role in implementation of rebuilding works. When a vacuum is created at the grass root level regarding the essential information, a desired pace cannot be achieved. A proper information flow mechanism from the implementers to bottom level can be enabled through the help of orientations and information hubs. As the country has emerged itself into the Federalism mode, the role of local government is to ease the aforementioned issues. However, to better undertake these actions they must be capable enough to plan and execute the appropriate measures for which their capacity itself requires upliftment first. Training programs for local authority, seminars and workshops can play a dynamic role in these cases which are learnings of NSET. Besides, all these there is a pertinent concept of establishing Reconstruction Centers in various levels (District & Local) whose work is to extend helping hands in all these activities. In the preliminary days government had developed the concept of this provision, however in reality this plan could not get the shape. The center is a hub for providing trainings, social/technical counselling and support for safer housing. These can however be a great learnings for Nepal as well as other countries while implementing post disaster reconstruction.

Intervention through Socio-Technical Assistance

National Society for Earthquake Technology-Nepal (NSET) has also been implementing Baliyo Ghar program-under support of USAID, which is providing socio-technical assistance to certain earthquake affected districts in order to provide assenting supports to beneficiaries there, which is a distinct method being implemented. The program through the help of Reconstruction Technology Centers (RTCs) and Mobile Teams are providing technical assistance creating awareness as well as enhancing capacity through trainings as an affirmative effort to promote earthquake safer housing reconstruction under the owner driven approach (**NSET ,Safer Society Report 2017**). The key approaches being made by program to make the assenting efforts are illustrated below:

i. Awareness Creation

A good mode of communication can aid in exacerbating the awareness, enhance the community morale as well as can aid in uninterrupted transfer of knowledge among the parties (**Sadiqi et al., 2016**). The level of awareness plays a significant role in every activities as they determine the level of intervention that needs to be made in order bring changes in the perception of people. Keeping this in mind, the program adopts the awareness related sittings regarding the essence of constructing disaster resilient buildings in order to build back better. In the scenario of developing countries like Nepal without the involvement of the community members, it is never possible to ensure disaster risk reduction measures there (**Dixit, A.M., 2014**). Hence the program approaches the same involvement process of community as well as raising their perception level to increase the demand of resilient construction practice in long term goals.

ii. Capacity Enhancement

In order to meet the increased demand through awareness, the capacity of construction workforce/designated authorities must also be enhanced to meet the desired workmanship level. The capacity enrichment trainings also help to empower the locals and can make them able to use their potentiality in reconstruction activities. Importantly, the capacity enhancement fortifies the community characters and qualifies them to be self-reliant in future (**Madubuko et al., 2009**).The modes of capacity enhancements trainings are illustrated below:

- Masons and Contractors, who are the ones directly involved in construction are provided with the trainings in order to make them aware on the seismic resistant construction practice
- Training to Engineer/Sub-Engineers inspecting the rebuilding process in order to guarantee the resilient construction practice: Technical professionals who are directly involved in the supervision process should also be trained in order to ensure safety of the reconstructed buildings. The curriculum that is under practice for engineering education
- Training to Social Mobilizers in order to enlarge their horizon as well as to lighten the areas of societal aspects to be dealt in safer reconstruction.
- Capacity Enhancement of Government Officials and stakeholders to address the grass root level demands of reconstruction and address the reconstruction concerns in the policy level.

iii. Institutionalization of Achievements

The attainments of the reconstruction will take us nowhere until and unless they are institutionalized and get inherited under the policy level of government. Previous studies have shown that achievements of reconstruction can be positively influenced by well-planned policies in form of legislatives & regulatory frameworks (**Rotimi & Zuo, 2009**).Bearing this in mind, the program through development of standard training curricula, manuals, checklists, summits and workshops contribute towards the institutional

development, which will later help to heighten the surviving capacity of public to self-function without any outer backings in disastrous events (Sullivan,2003)¹.

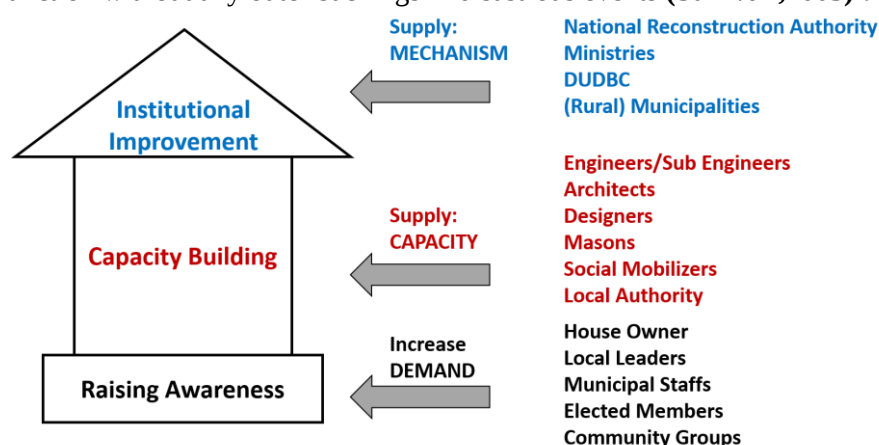


Figure 5. Conceptual framework of socio-technical assistance in post-earthquake reconstruction as implemented by Baliyo Ghar Program (Source: NSET)

Impacts of socio-technical assistance in housing reconstruction

As discussed earlier, a consortium of different activities pertaining to raising awareness, enhancing capacity and facilitating institutionalization of disaster resilient construction approaches is of paramount importance for the success of any reconstruction campaign and sustainability of the approaches. Socio-Technical assistance plays a significant role in expediting the progress as well as compliance of buildings. The National Reconstruction Authority has identified 7 major components or activities under a full package of socio-technical assistance. These include short trainings, vocational trainings, mobile technical support, demonstration construction, establishment of help desks, community based orientations and formation of community reconstruction committees. The impact of coverage of these socio-technical assistance can be seen both in the progress and compliance of the buildings in post-earthquake reconstruction in Nepal. Figure 6 illustrates the comparison of progress of reconstruction in different communities in Nuwakot district with varied number of coverage of the aforementioned socio-technical assistance activities.

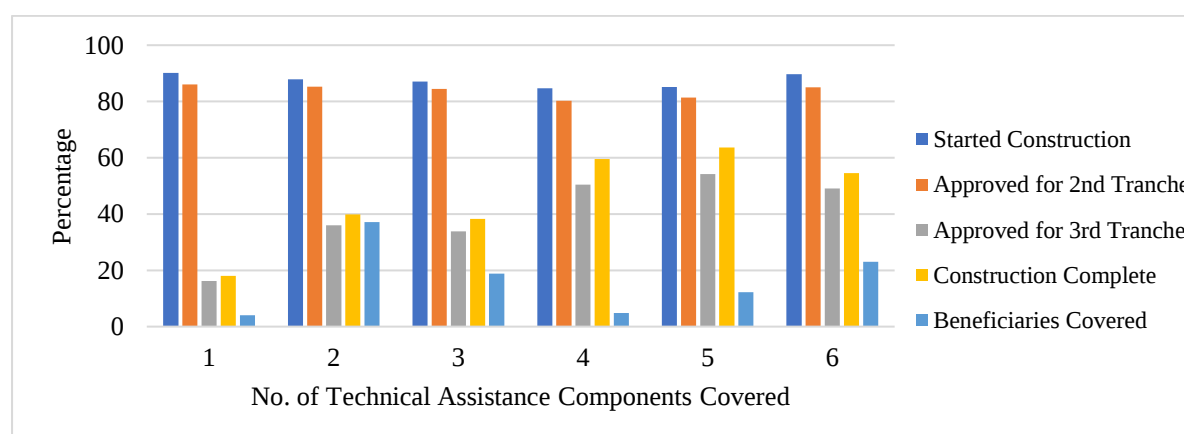


Figure 6. Comparison of progress of reconstruction in communities with different levels of coverage of socio-technical assistance (Data Source: NRA/DLPIU Building and HRRP)

The graph above shows the progress of housing reconstruction in different areas (previous VDCs) in Nuwakot as per the availability of technical assistance components. Of the total 72925 listed

¹Cited in Rotimi & Zuo's article "Legislation for Effective Post Disaster Reconstruction."

beneficiaries in Nuwakot, the percentage of beneficiaries having access to one, two, three, four, five and six components of technical assistance are 4, 37, 18.8, 4.8, 12.2 and 23 respectively. Likewise, a comparative study of the progress of reconstruction in these areas shows that the percentage of beneficiaries that have started construction and received the second tranche is much similar in all the communities. However, a significant difference can be seen in the completion and 3rd tranche distribution trend. As seen in the graph, the percentage of beneficiaries that have completed construction and have been approved for the 3rd tranche by the NRA/DLPIU Building is much lower in the areas with up to 3 TA components as compared with areas that have higher number of TA components covered. Keeping this in mind, it is evident that availability of comprehensive socio technical assistance package has a direct positive influence in the overall progress of reconstruction and can expedite towards the completion of construction.

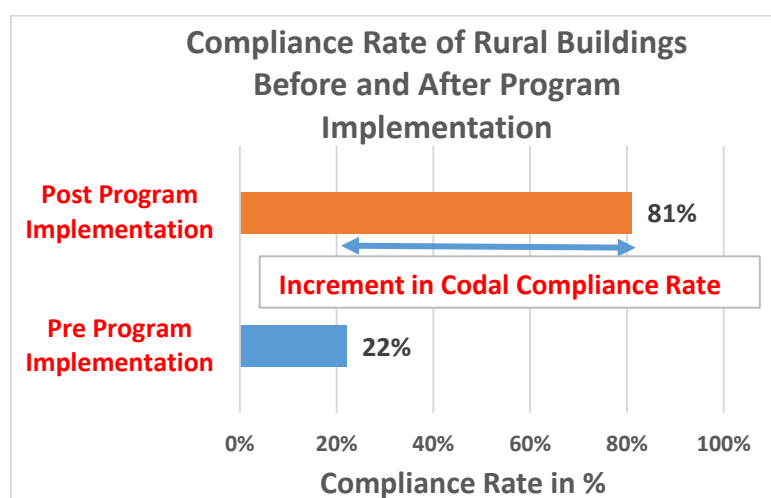


Figure 7. Compliance of rural houses to the National Building Code: Before and after implementation of Baliyo Ghar Program (Source: NSET)

The figure 7 depicts the change in compliance rate of buildings before and after the access of earthquake affected communities to socio technical facilitations through Baliyo Ghar Program. Of all the houses built after the earthquake in the four districts before the deployment of assistance through the program, only 22% were compliant to the National Building Code while the compliance rate rapidly increased to 81% after the implementation of the program.

4. CONCLUSION AND RECOMMENDATION

Post earthquake reconstruction of residential houses is a huge endeavour for any nation, and it is more significant for developing countries like Nepal. The huge amount of investment, both monetary and human resource must be amounted towards rebuilding disaster resilient communities that are able to recover their economic livelihood as well. To that end, a comprehensive approach of socio-technical assistance must complement the financial assistance to be provided to earthquake affected beneficiaries. The strategic objectives laid down in the PDRF have provided specific guidelines towards promoting disaster resilient housing reconstruction. As such, efforts of programs like NSET's Baliyo Ghar which works at various levels of concerned stakeholders is of paramount importance for achieving the desired goal of "Build Back Better." Further, the loss of traditional vernacular architecture and change in communal structures must be accounted for during the planning and implementation of post disaster reconstruction and rehabilitation programs to ensure that communal impacts of such disasters are minimized. Learnings from the current reconstruction process must be incorporated into the formulation of better policies that adequately address the needs and necessities of all communities. A separate study regarding the impact of ongoing internal and external migration due to the 2015 Gorkha earthquake can be vital to understand how communities respond after a disaster and will help articulate better disaster management plans at the national, district and local level.

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