Building Code Implementation: Way to Stronger Nepal

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ABSTRACT

Nepal National Building Code, prepared in 1994, announced for implemented in 2003, was introduced in Damak Municipality in 2012. In these two years of period, Damak did significant work and progress in implementing building code.
During the implementation, the road up to here was not so easy but the approaches adopted for the implementation helped the municipality to mark this success. The initial work was the identification of stakeholders. The main four stakeholders for the implementing process are Municipality, House owners, Mason groups and Technical society. The first and most challenging work is to increase the level of understanding of these stakeholders to the same level and maintain that equilibrium state during the entire process. So, after identification of stakeholder, three level of work was done, first is increase awareness level of the people of municipality, second capacity building trainings for masons, technical groups and most importantly house owners, and third institutionalization of the process by municipality. The strong monitoring and guiding system of the municipality and equal responsibility distribution between the stakeholders for this process was key of the success.
In around two years of period, Damak transformed itself from a municipality without any building code provisions in building permit system to an example municipality to effectively implement the building code. As a result, most of the newly constructed buildings in Damak are compliant to building code. But, still there are challenges to keep this momentum for long period.
From Damak municipality, other municipality of Nepal can understand that building code implementation process is difficult but not impossible.

Keywords: implementation, stakeholders, awareness, trainings, institutionalization

1. AN INTRODUCTION TO BUILDING CODE IMPLEMENTATION

Building Code is a technical document with minimum standard which guides the construction of structures. And the code is prepared by any country as per identified hazards, and economical acceptance of the individual country. In Nepal, National Building Code regulates the construction of all the buildings to be constructed in Nepal which specially guides the structures to an improved seismic performance level. It was prepared in 1994, after the feel of need after 1988 earthquake as Nepal lies in an earthquake prone zone, which consists of four levels as per type of structures to be constructed:

1. **International State of Art**: It is for those buildings/structures, designed using the building codes of other countries. Nepalese Engineers and international consultants can use the code but structure should maintain minimum Nepalese standards.

2. **Professionally Engineered Buildings**: It is the code which can be used by qualified Engineers for the design of buildings. And this is a minimum standard for designing any structures in Nepal.

3. **Mandatory Rule of Thumb**: In Nepal, there is limited access of professional engineers to design all the buildings and it is practically not possible to design all buildings by a professional Engineer. Mandatory Rule of Thumb is a ready to use code which covers those residential buildings with limited height, span, and no. of storey, and floor area but can be constructed both RC frame and Masonry load bearing structures. This part of building code covers most of the residential buildings of Nepal. The explanatory documents are such that an experienced junior engineer is able to understand them and present sufficient details at the time of permit application and construction process.

4. **Guideline for remote rural Buildings**: This guideline focuses on those changes that should be made to current practices to improve the seismic resistant of rural buildings which are not subject to modern quantitative analysis and rational design consideration. These structures are normally of earthen construction (unfired masonry, mud mortar, rubble, dry stone etc.).
And this mandatory rule of thumb part and guidelines for remote rural building covers more than 80% buildings of Nepal.
After the decision of government to implement the building code in Nepal in 2003, Damak municipality decided to implement it in 2012 with the continuous guidance and technical support from NSET through Building Code Implementation Program in Municipalities of Nepal (BCIPN). With the reference to the experience of NSET on implementation of building code in different municipality projects like Municipal Earthquake Risk Management Project suggests that the Building Code itself is a technical document but when it comes to the time of implementation it is more social issue than technical.

2. APPROACHES ADOPTED

The proper coordination between all the stakeholders is the key to success in building code implementation. Municipality had decided that following should be mandatory to be sure for proper implementation of building code practically:

a) There should be appropriate design of building as per National Building Code. Also the maps which comes under building permit process must be as per NBC.
b) Quality construction at field as per permitted map.
c) Use of quality materials at field with good workmanship.

To get the expected success in the implementation proper strategy is necessary. As this building code implementation part is a function of all the stakeholders, if any variables of this function turns negative building code implementation is impossible. So, following is the strategy adopted:

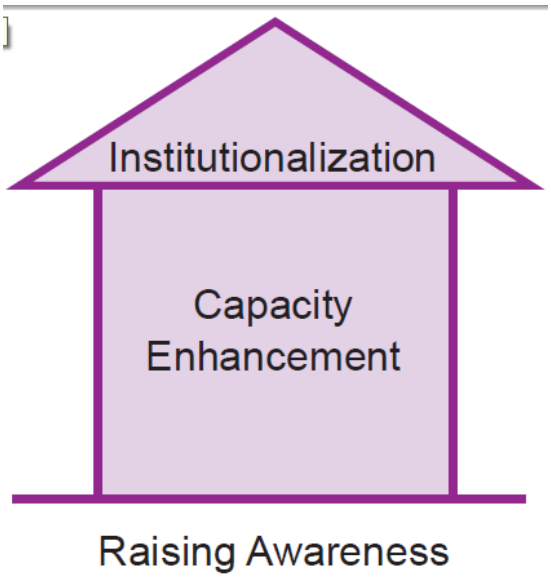

Figure. 1 Strategy for effective building code implementation

Building code implementation is a process which can be compared to a building as shown in Figure.1. For proper and successful implementation of building code every element of above building should be strong enough.
Four main stakeholders identified by Damak municipality which may influence the building code implementation are as follows:

1. Technical Society
2. Masons and Petty contractors
3. House Owners
4. Municipality

Other stakeholders which may act as catalyst; positive catalysts when used properly and negative catalysts if not used properly are:

5. Media
6. Political Society
7. Community

2.1 Raising Awareness

In a building, foundation is most important part, without strong foundation no any superstructure can perform well. Just like that in the process of building code implementation raising awareness is the base of the entire process. But it is necessary to find out the proper stakeholders to be oriented for this. It contains not only what to do, it must contain why to do. This answer is given in the awareness programs. The main purpose of this part is to create a desire to construct earthquake resistant building as per building code. There may be additional stakeholders to be oriented but from the experience of Damak basic stakeholders to be oriented are as follows:

2.1.1 Political Leaders

Political leaders can play a pivotal role in any of the social decisions. Without the realization by political leaders, the importance of the implementation of building code, it is not even possible to announce the implementation of building code. There is need of intensive interaction between political leaders and municipality, and create a same positive perception to implement the building code for easy implementation of the building code.

2.1.2 House Owners

For effective implementation of the building code self-realization by the house-owners to construct earthquake resistant building is necessary. Everybody want to build their house safe, stronger and earthquake resistant. The only thing that leads house owners not to build the earthquake resistant building is due to the fear of cost. But, in Damak and in most of the Nepal, just 5-10% addition in the cost of normally constructed buildings results the earthquake resistant building. If the design, materials, and manpower are carefully managed than it may cost even less. So, there is necessity of creating a situation of craving for earthquake resistant buildings from the house owners. This can be created by orienting them on how to construct such buildings, why to construct, and how much it costs. These kind of orientation is must because during implementation of building code, if a house owner wants to build an earthquake resistant building than no one is there to restrict him on constructing safer building but if this group stands against the implementation than it would be very difficult to implement. A house owner is the one which is most important stakeholder in building construction but the most immature one, because a house owner constructs a building in his lifetime and believes his/her nearest one, his/her hired masons, technical personnel. So, if they are oriented to the better direction before they go to wrong one then building code implementation also goes in right direction. The right time to orient them is just after they come to building permit process.

The only purpose of these kind of orientations is to make the house-owners understand and accept the importance of the safety of the buildings in which they are investing, make prepare them to pay a little extra for safety and suggest them to hire qualified and experienced designers and trained masons or contractors.

2.1.3 Social Mobilizers, Tole leaders

These groups are the secondary stakeholders but can influence the primary stakeholders. People believe what they say, people copy what they do, and people follow their footsteps in most of the case. If this group spread a good vibes about the building code in the community can create demand of building code implementation.

2.1.4 Media

Media can reach the every people around. If it passes the right message effectively, then it can create a good environment. But it is necessary to orient this group during the implementation process such that they pass right message to the audience. Also, municipality can spread some messages related to building code implementation, also messages regarding safer building constructions which may influence the public. Right use of the media will be a positive catalyst for the implementation process.

2.1.5 Community Awareness

Unless all people of the community are not aware to the safer construction, building code implementation is difficult. As neighbor of any house owner can influence most than any other to build a building safer or not. Because anyone believes his/her relatives, neighbors more than any other and if that relatives and neighbors who are not aware to the building code may affect negatively to the house owners resulting ineffectiveness of building code implementation.

Other alternatives for raising the awareness level of the community used by municipality are:

1. **Mobile clinic**: The concept of "Mobile Clinic" is to provide onsite consultation in aspects of earthquake- resistant building construction. A team of Engineers

from municipality, consultants visit different locations / building construction sites in specific areas and provide technical advice. The aim of the clinic is to improve seismic performance of buildings being constructed by the untrained masons.

2. **Earthquake Safety Day Awareness Programs**: Government of Nepal has declared Magh 2, January 15 (or 16) as the Earthquake Safety Day of Nepal. Using this day as a day for raising awareness, municipality does different activities like Rally covering municipalities, distribution of informative publications, symposium between stakeholders, talk programs related to earthquake safety and Shake table demonstration.
3. **Informative visual display in municipality office**: Municipality has installed TV for the information sharing about the municipality news, which also covers the information regarding building code and other tips regarding earthquake resistant building construction.
4. **PSA through TV and Radio:** Regular informations through TV and Radio regarding building code implementation help to reach the community.

2.2 Capacity Enhancement

This is like the superstructure of the building which is most needed and visible requirement by everyone. As building code is a technical document, so for proper implementation most of the implementing agencies and people needs their capacity enhancement. First work was to identify the stakeholders who needs the capacity enhancement trainings. It was identified the following as the potential stakeholders to be trained:

1. Masons
2. Petty contractors
3. Municipal Engineers
4. Consultant Engineers

NSET focused on capacity enhancement of local champions and municipality staff for sustainable long run of the implementation process. NSET provide technical assistance to the municipality throughout this process.

2.2.1 Masons/ Petty Contractors

More than 90 % buildings in Damak municipality constructed by the owner at the guidance and involvement of petty contractors and masons who lacks any modern knowledge on earthquake resistant construction. Most of the buildings constructed in the municipality area constructed can be covered by mandatory rule of thumb (MRT) part of the building code but unfortunately they were all constructed only with the help of untrained masons and contractors resulting unsafe construction. It shows that, after the announcement of building code implementation, without the special consideration of this group more than 90% buildings cannot be constructed earthquake resistant. So, this is one of the main stakeholder for building code implementation.

But, the real scenario is that this group which governs 90% of the building construction have got no any formal education for earthquake resistant building construction. They have only learned to construct buildings through their seniors, they have learned what their seniors taught them. But, the thing is that the seniors who taught them are also unaware of earthquake resistant building construction. So, more and more trainings on earthquake resistant building construction for masons and contractors is necessary to make those buildings safe. These trainings are for the masons who are already masons but constructing buildings in their own traditional

way.
Municipality of Damak decided as mandatory to be at least one mason who is trained on earthquake resistant building construction. Such that, the trained mason can guide other untrained masons in the field. Damak municipality trained more than 50% of the masons in different series of trainings.
The trainings are basically in form of interaction, photographs display, site visit and practical model exercises on key elements of seismic safe construction for different building types.

2.2.2 Municipal and Consultant Engineers

As Building Code itself is a technical document, so role of technical manpower in its implementation is primary. In case of Damak and also in most of the municipality of Nepal, understanding the building code itself technically by the consultant engineers and self-realization of importance of its implementation by them is the first step to the journey of implementing the building code. As in Damak municipality, where building permit was mandatory before the announcement of implementation of building code, the role of Engineers and Technicians was to make a plan of Buildings and clear the building permit process. In that time, building permit systems only concern was to make sure of compliance of building By-Laws. After announcement of the Building Code, structural design of the building and its structural drawing with addition of architectural drawing requirement is to be done as per the Nepal National building code and this most initial work of implementing building code is entirely technical part and it goes under the arm of the technical society.
The buildings should be properly designed first of all such that to build the building earthquake resistant in the field also. The faulty design leads to a faulty construction, so it is necessary to train the engineers who designs and draws the buildings and it is also necessary to train the engineers within the municipality for the checking of submitted designs and drawings of the buildings. Damak municipality decided to give the trainings to the consultants and municipal engineers firstly on basic course on earthquake resistant building design and construction, which course contains the basic things that must be considered during designing the buildings and focuses mostly on buildings which lies under mandatory rules of thumb. Because, according to municipality, more than 80% of building constructed inside the municipality lies under this category.
It is also necessary to design the buildings through consultancies which are registered in the municipality. And the building construction supervision also should be done through the consultant engineers. Municipal Engineers assures the every stage of the building permit process is going as per the building code.

2.3 Institutionalization

As much the roofing of the building is important to protect the superstructure, institutionalization of the whole building code implementation process is necessary for the effective implementation for the long term.
Most of the responsibility for the institutionalization of this process falls under the arm of municipality. The entire work for the proper institutionalization of the building code implementation by the municipality are as follows:

Announcement of Building Code Implementation:

- The very first work is to announce the building code implementation after the

proper background development. Before the announcement intensive interaction with political leaders, technical society, and other intellectual groups is necessary.

- During the same time awareness programs to the stakeholders and capacity enhancement trainings for masons and engineers are to be coordinated by the municipality.

Incorporation of Building Code and Building By-laws In the Same Building Permit System:

- Incorporation of building code in building permit process is the most important and critical work. As municipality already have the building permit process which contains mostly the by-laws, it is felt necessary to incorporate the building code also within the permit process and municipality was successful for that.

Masons and Consultants Regulation System:

- It is necessary to bring all the main stakeholders of the implementation of the building code under the same umbrella.

To assure that, municipality needs to register and license the trained masons within the municipality and give them the appropriate responsibility. Damak had licensed the trained masons and at least one trained mason in one building construction site was maintained. It was ensured by taking the responsibility signatory by the trained mason in the building permit process and also regular field monitoring by the municipality. Also, there must be the rules and regulations to regulate the masons such that they will not do any works against the building code.

Another group is the group of consultant engineers who designs the buildings. Municipality needs to register the consultancies who can design the buildings within the municipality area. Municipality also confirms the capacity of the consultants and provides capacity enhancement trainings if needed. Damak has decided that every new building designs and maps must come through these registered consultancy such that they will be responsible for any consequences. Also there must be availability of consultants during the construction for the supervision but it need not to be the consultant who designed the building.

Hiring the masons, consultants and complete the entire building permit process through the municipality, this responsibility lies under house owner. Municipality is now planning for contracting house-owners, masons and technical consultant with their responsibility to make each of them more responsible.

Monitoring by Municipality in Field

- Under the municipality, creation of a section which checks the map and assures the design to be correct is necessary. Also, it also confirms the construction of the building is running as per the design and drawing or not in every stages of construction. In Damak, mainly three times the buildings are monitored by municipal engineers: 1. At the time of layout 2. Before the start of superstructure 3. After the completion of superstructure. This monitoring system also ensures the quality of the construction.

Supporting Groups for Building Code Implementation

- Development of building code implementation supporting groups is the one that other municipality can learn from Damak. There are building code implementation supporting group of masons and technical cell of consultant engineers, whose main purpose is to support municipality during this entire process.

And this is the strength of Damak municipality to be so successful in short period of time. These groups lies under the umbrella of the municipality.

Role of supporting organization

- During the implementation process collaboration with the organizations like National Society for Earthquake Technology –Nepal (NSET) for the technical support to train the masons and consultant engineers, orient different stakeholders, develop strategies throughout the process of implementation ease the implementation process through its Building Code Implementation Program in Municipalities of Nepal (BCIPN). As NSET had already work for effective building code implementation in other municipalities with same socio-economic status, the strategies developed by NSET for effective implementation of Building Code through BCIPN guide Damak to the road of success in building code implementation.

NSET did support municipality in almost all of the municipal activities; awareness, capacity enhancement, and institutionalization process during this period.

3. LESSON LEARNT AND CHALLENGES

From the learnings of the Damak, it is proved that building code implementation process obviously is difficult but not unachievable. Building Code Implementation in Damak municipality is running smoothly now. But still there are more challenges to resolve and works to do:

1. Technical community, masons, municipality, house owners, political leaders, media and community are the main stakeholders for the building code implementation process. The synergetic cooperation between all stakeholders is key to success of building code implementation and it is required to maintain the equilibrium state between all the stakeholders for long run. Controlling the building construction by enforcing the building code through strict rules and regulations is important thing but capacity enhancement of technical community and masons and convincing other stakeholders for safer construction should be promoted for sustainable implementation.
2. An auto running mechanism within the municipality for the implementation of building code is necessary. Incorporation of building code within the building permit system, make the stakeholders more responsible by creating supporting groups like technical cells and masons group of Damak, regulation of technical manpower and masons through licensing, strict field monitoring system, are some of the works that can be learnt from Damak municipality.
3. Approaches must be in a sequence of not increasing the earthquake risk by constructing new buildings safe and then decreasing the earthquake risk by retrofitting the old vulnerable buildings. According to Damak municipality, more than 75% of the buildings which are newly constructed are according to building code but still there are old building which are constructed before the implementation of building code and are very vulnerable to the earthquake. There is challenge to make them safe and Damak is focusing on retrofitting of such buildings.
4. High priority must be given to local manpower and resources in order to ensure sustainable implementation. Till now, NSET or DUDBC is supporting for the capacity enhancement and awareness program but for the sustainable long run, development of local champions for conducting such trainings is felt necessary.

For this, NSET has developed some of the trainers inside and outside municipal office also but is not sufficient and needs to develop more of them for sustainable long run of the implementation.Still there are more masons and contractors who are to be trained on earthquake resistant building construction. And this training process is a regular task which needs to be continued for a long time.

5. House owners are the key for the safer building construction, so orientation on earthquake resistant building construction for the house-owner should be regular. They should be oriented in such way that they not only be convinced to the safer construction, they can also supervise and monitor the construction.
6. Program like Building Code Implementation in Municipalities in Nepal (BCIPN) of NSET should be continued. The approaches adopted in Damak municipality by BCIPN is successful in Damak and its impact is replicated in the nearby VDCs and municipalities as well.

4. IMPLICATIONS

Obviously, Building Code implementation process is difficult but it is still achievable. It is a process which cannot be achieved over a night but if there is strong monitoring and guiding system of the municipality and equal responsibility distribution between the stakeholders, it is possible. From Damak municipality, other municipalities of Nepal can learn and replicate it for easy implementation of building code.

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