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Assessment of Knowledge and Awareness Regarding NBC and Bylaws: A Case Study of Compliance and Awareness in Sundarbazar Municipality, Nepal

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Abstract

In Nepal, seismic risks are imminent due to its location on the boundary of the Indian and Eurasian tectonic plates. This study delves into the implementation status of the National Building Code (NBC) in Sundarbazar Municipality, focusing on factors such as Mandatory Rule of Thumb (MRT) compliance, institutional mechanisms, awareness levels, and perspectives. The investigation reveals challenges in the adopted method and institutional structure for building code implementation, particularly stemming from a shortage of staff. Both primary and secondary data sources were utilized, with stakeholders including house owners, local contractors, consultants, and municipal technical personnel providing primary insights. The study uncovers a disparity in awareness levels, with technical personnel exhibiting positive perspectives on building bylaws, while local contractors display unfamiliarity. Drawing on a sample of building permits issued, the evaluation includes Class C and Class B building design drawings, highlighting complexities in the application process for Class B structures. This research signals the need for a reevaluation of the building code implementation strategy in Sundarbazar, emphasizing the importance of addressing knowledge gaps and enhancing institutional capacity. The findings contribute to a nuanced understanding of the challenges hindering effective building code compliance and suggest avenues for future research and Policy adjustments.

Keywords: Building Permit, Bylaws, Compliance, Stakeholders

1. Introduction

According to seismic data, Nepal experiences earthquakes with a Richter scale magnitude of 8 or higher approximately once every 80 years. The first recorded earthquake in the nation's history occurred in 1255, and subsequent seismic events, including the 1934 earthquake with a magnitude of 8.3 on the Richter scale, have marked the region's susceptibility to such disasters (DPNET Nepal, 2017). The destructive 6.9 Richter scale earthquake near the Indian border in 1988 further emphasized the vulnerability of the area. The most recent significant earthquake struck Nepal on April 25, 2015, with a magnitude of 7.6 Richter scale and an epicenter in Barpak, Gorkha, and a hypocenter at a depth of 8.2 kilometers. This event was followed by a primary aftershock of magnitude 6.6 on the same day, a magnitude 7.3 aftershock on May 12, 2015, and 479 subsequent aftershocks with a magnitude of 4 or higher until February 4th, 2017 (NSC, 2017). According to the 2011 census, there were only 58 recognized urban areas, accommodating 17.1% of Nepal's population. However, with the addition of 159 new municipalities in 2014–15, 40% of the population now resides in 217 officially recognized urban areas (NUDS, 2017). The state reorganization has resulted in more than 50% of the population living in metropolitan areas, with over 20% concentrated in Kathmandu, the capital of Nepal. Remarkably, more than 98% of the buildings in Nepal are constructed by owners in consultation with local craftsmen. However, these owner-built structures often do not comply with the National Building Code (NBC), making the implementation of the NBC a pressing issue in Nepal (Dixit, A. M., 2008).

Historically, most municipalities and Village Development Committees (VDCs) in Nepal only required architectural designs to obtain building permits. Despite the government's enforcement of the construction code for over a decade, municipalities and rural areas struggle with effective implementation due to a lack of technical staff and sound policy, particularly after the adoption of the federal system.

An essential phase in the "Build Back Better" approach following an earthquake is the successful implementation of the National Building Code (NBC), which provides rules and guidelines for seismic resistance in construction. Building construction permits are granted by local government entities only if the building complies with the NBC and Bylaws, making the NBC the sole legal document for ensuring safer construction. Subsequent to the 1988 earthquake, the Nepal National Building Code was initially drafted in 1994 and officially approved in 2003. However, even after more than 20 years, implementation remains a significant challenge.

Municipal bodies or authorities will not issue building permits for structures that do not adhere to building bylaws. This study focuses on evaluating the compliance status of individual residential structures with the NBC in Sundarbazar Municipality, Lamgunj located in the Gandaki Province Nepal.

1.1 Objective

The primary objective of this study is to analyze the level of knowledge, perspectives, roles, and responsibilities of key stakeholders, as well as the challenges associated with the effective implementation of building codes and bylaws in Sundarbazar Municipality.

1.2 Study Area

The study focuses on Sundarbazar Municipality in the Gandaki Province, specifically within the Lamjung District of central Nepal. Sundarbazar Municipality was formed through the amalgamation of nine different Village Development Committees (VDCs) in Lamjung district. Geographically, it is bordered by Besisahar Municipality to the north, Dordi Rural Municipality, and Rainas Municipality to the east, Bhanu Municipality to the south, and Madhya Nepal Municipality to the west. The total area of Sundarbazar Municipality is 72.03 square kilometers, with a population of 26,864 residents distributed across its 11 wards with 28° 7' 31" Northing 84° 25' 4" Easting.

2. Methodology

2.1 Sample Methods and sample size

This research employed a purposive sampling method to select the sample population. Purposive sampling is a non-probability technique wherein the researcher relies on their own judgment to select members of the population for study participation. It involves the deliberate selection of elements based on the researcher's judgment, with the belief that this approach can yield a representative sample, thereby saving time and resources (Black, 2010).

The study population comprises various stakeholders, including technical professionals, administrative and technical staff of the municipality, consulting firms/designers/engineers, local contractors and masons, house owners, and the general public within Sundarbazar Municipality. Building samples that had received permits and were in the implementation phase following compliance with the National Building Code and Bylaws were selected for verification. This targeted approach aims to capture diverse perspectives and experiences related to building code implementation within the municipality.

Table 1: Sample Method and sample size

Description	Total population size	Consider for study	Remarks
House owner	46	46	All house Owner was considered.
Local contractor	13	13	All Local Contractor were considered.
Consultant	10	10	All consultant were considered.

Municipal personnel	technical	11	11	All technical personnelwere considered.

2.2 Research Approach

The research utilized a combination of quantitative and qualitative approaches to comprehensively address the issues related to the compliance status of the National Building Code and Bylaws.

Quantitative Approach:

Standardized structured questionnaires were employed to gather quantitative data. These questionnaires were designed to assess the level of compliance with the National Building Code and Bylaws. The questions were formulated to elicit responses regarding awareness, capability, and perspectives on building bylaw implementation. The quantitative approach provided a systematic and standardized means of collecting data from the four identified stakeholders:

- The Designer (Consultant)
- Municipal Engineer and Technical Personnel
- The Contractor
- House Owners
- Qualitative Approach:

Field studies, key informant interviews, and observations were conducted to collect qualitative data. These methods allowed for in-depth exploration and understanding of the nuances and complexities associated with building code implementation.

Data Collection and Analysis

Primary Data: Primary data were the main sources of information for this study. Questionnaires were designed to gather opinions from respondents on awareness, capability, and perspectives regarding building bylaw implementation. Four stakeholder groups received a set of generalized questions.

Secondary Data: A comprehensive review of government policy documents, laws, literature manuals, instructions, journals, and project documents were conducted, both online and offline. Publications from the municipality, including Municipal Council Documents, organizational charts, and other relevant records, were collected and analyzed.

Research Matrix

The research matrix, presented in the table below, outlines the connection between the research objectives, data collection methods, and the corresponding outputs obtained from achieving these objectives.

Table 2: Research Matrix

SN	Research Objective	Date Collection source	Output
1	To scrutinize and analyze the level of knowledge, perspective, roles and responsibilities of concerned stakeholders and challenges in effective implementation of building code and byelaws.	Questionnaire survey, key informant interview	Comparative analysis of questionnaire
2	To show the status of compliance of National Building Code and Bye laws of Sundarbazar Municipality.	Study of municipal records, building codes, byelaws, legislative and other relevant documents Field study &observation Approved drawings & building permits/certificates	Status of compliance of NBC and Byelaws

2.2 Validity and Reliability of Research

Cronbach's alpha coefficient used to test the reliability varies from 0 to 1; the closer the coefficient is to 1, the more reliable the scale. The Cronbach's alpha coefficient of scale should be above 0.7; however, it is common to find low Cronbach's alpha coefficients, for example, 0.5 for scales with fewer than ten items (Pallant, 2005). The reliability of a scale varies depending on the sample that is used (Pallant, 2005). For this study, it.Data was captured and analyzed using the Statistical Package for Social Scientists (IBM SPSS Statistics 29.0) to determine chronbach alpha coefficient. Results were presented below:

- ❖ Excellent (0.91-1.00)
- ❖ Good (0.81-0.90)
- ❖ Good and Acceptable (0.71-0.80)
- ❖ Acceptable (0.61-0.70)
- ❖ Not Acceptable (0.01-0.60) (Konting et al.,2009)

Results from the analysis indicated the following Cronbach alpha values:

- ✓ Municipal Technical Personnel: 0.75 (Good and Acceptable)
- ✓ Designer/Consultant: 0.72 (Good and Acceptable)
- ✓ Local Contractor: 0.68 (Acceptable)
- ✓ House Owner: 0.82 (Good)

These results demonstrate that the research instruments exhibited good to excellent reliability across different respondent groups, reinforcing the credibility and consistency of the study's measurements.

3. Results and Discussion

3.1 Knowledge and Awareness of Stakeholders

The level of knowledge and awareness among stakeholders is crucial for understanding the compliance status of the National Building Code (NBC) and Bylaws. To gauge this awareness, general questions related to earthquakes, their consequences, earthquake-resistant design, construction processes, building code provisions, and Mandatory Rule of Thumb (MRT) provisions in bylaws were posed to the concerned stakeholders.

Table 3: Knowledge regarding Earthquake

SN	Description	Houseowner			Contractor/Masons			Consultants			MunicipalTechnicalPersonnel		
		46			13			10			11		
		I	II	III	I	II	III	I	II	III	I	II	III
1	Knowledgeabout Earthquakeanditsconsequences	19	26	1	2	8	3	1	3	6	1	4	6
2	Knowledgeabout earthquake resistantdesignandConstruction process	28	18	0	4	9	0	2	3	5	2	4	5

3.2Knowledge Regarding NBC and MRT Provisions

To gauge stakeholders' awareness of National Building Code (NBC) compliance and Mandatory Rule of Thumb (MRT) provisions, a comprehensive questionnaire was designed. Stakeholders, including contractors, consultants, and municipal technical personnel, participated in the survey. Results indicated varying levels of knowledge among stakeholders regarding NBC guidelines and MRT provisions. This essential insight serves as a foundation for understanding the current compliance landscape and points toward potential areas for targeted education and improvement initiatives

Table 3: Level of Knowledge of Stakeholders regarding the NBC

Sno	Description	Contractor/Masons			Consultants			Municipal TechnicalPersonnel		
		13			10			11		
		I	II	III	I	II	III	I	II	III
1	Knowledge regarding National Building Code	7	3	3	0	5	5	2	3	6
2	Knowledge regarding MRT provisions of NBC	8	3	2	0	5	5	2	3	6

I: No knowledge II: General knowledge III: Sufficient Knowledge (Source: Field Survey, 2023)

a. Perspective of Concerned Stakeholders, Building Permit Procedure, and Approval Status

Table 5: Perspectives of Concerned Stakeholders

Stakeholder	Aspect	Response Count/ Percentage
House Owners	Familiarity with Byelaws	Familiar: 24 (52.17%), Not Familiar: 30 (47.83%)
House Owners	Perspective on Byelaws Compliance	Effective Compliance: 30 (65.22%), Ineffective Compliance: 11 (23.92%), Uncertain: 5 (10.87%)
Technical Personnel	Proper Approach	Supervision (5), Strict Rules and Regulations (2), Building Code (1), Awareness (1)
Technical Personnel	Proper Approach	Supervision (4), Strict Rules and Regulations (4), Building Code (2)

House Owners	Researson for Adoption to Byelaws	Legally Enforced: 14 (30.43%), Earthquake Safer Construction: 32 (69.57%)
Contractors/Masons	Familiarity with Byelaws	Familiar: 4 (30.77%), Not Familiar: 9 (69.23%)
Contractors/Masons	Building Permit Procedure	Complicated: 9 (69.23%), Not Complicated: 3 (23.08%), Uncertain: 1 (7.69%)

Table 6: Building Permit Procedure and Approval Status

Stakeholder	Aspect	Response Count / Percentage
House Owners	Building Permit Procedure	Complicated: 29 (63.04%), Not Complicated: 15 (32.61%), Uncertain: 2 (4.35%)
Contractors/Masons	Building Permit Procedure	Complicated: 9 (69.23%), Not Complicated: 3 (23.08%), Uncertain: 1 (7.69%)
Consultants	Building Permit Procedure	Complicated: 6 (60%), Not Complicated: 4 (40%)
Municipal Technical Personnel	Building Permit Procedure	Complicated: 5 (45.45%), Not Complicated: 5 (45.45%), Uncertain: 1 (9.09%)
House Owners	Approval of Building Drawings	Before Construction: 35, After Construction: 11
Municipal Technical Personnel	Approval of Building Drawings	Before Construction: 11, After Construction: 0

3.3 Mason Trainings to Contractors/Masons

For effectively implementing seismic detailing and building code provisions on-site, mason training is crucial as it helps boost the technical skills and knowledge of masons and contractors. Results from the questionnaire survey with contractors and masons working on building construction sites indicate that only 40% of contractors/masons have received mason training.

Out of 13 contractor/masons, 6 (46.15%) responded that they have participated in mason training, and the remaining 7 (53.85%) have not received any training to date. This suggests that the municipality lacks trained masons, and concerned authorities should provide training to masons and contractors for skill enhancement in earthquake-safe construction.

This scenario indicates a lack of consistency in the approval process, and the management level fails to address these issues due to a lack of monitoring of the administrative and technical procedures within the municipality. The tracking system of the building permit process is deemed ineffective, making the process superficial and subjective.

4. Conclusion

This study in Sundarbazar Municipality revealed significant knowledge gaps among stakeholders concerning the National Building Code (NBC) and Bylaws. Notably, house owners demonstrated a better understanding of Bylaws compared to the NBC, while contractors and masons exhibited varying degrees of unfamiliarity. The positive perspectives of stakeholders on the effectiveness of Bylaws underscore the necessity for targeted training initiatives, particularly directed towards contractors and masons.

Technical personnel stressed the importance of supervision and strict adherence to building codes but highlighted deficiencies due to high workloads and limited engineering resources. The research identified inadequate mason training, emphasizing the urgent need for capacity-building measures.

In summary, this research advocates for a comprehensive approach to building code compliance in Sundarbazar. Addressing knowledge gaps, enhancing supervision, and implementing effective mason training should be

prioritized. These findings offer invaluable insights for policymakers and municipal authorities aiming for safe and resilient construction practices in earthquake-prone regions. Looking ahead, the study sets the stage for continued exploration, encouraging future research into improved building code implementation and sustainable practices in similar contexts. By fostering ongoing discussions and initiatives, we can pave the way for a safer and more resilient built environment in Sundarbazar and beyond.

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