

ASSESSMENT OF PROBLEMS ASSOCIATED WITH THE EMERGENCY SHELTERS DURING AND AFTER DISASTER IN HETAUDA SUB- METROPOLITAN CITY OF NEPAL

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ABSTRACT

The 2015 devastating earthquake affected Hetauda city and its suburbs, where high magnitude seismic force have damaged houses and buildings. The complete to partial destruction occurred mostly in traditional and non-engineered RC houses. The post recovery during and immediate after the disaster was less efficient as there is research gap in the actual displace population during earthquake. The study adopted the mix method where primary data were collected from field observation, in-depth interview, focused group discussion and questionnaire survey in the hetauda municipality on problems, challenges and effect associated with emergency shelter. The collected data were analyzed in Excel and RII formula was used for Likert scale questions. The analysis result showed that the Hetauda sub-metropolitan city have limited open spaces to build emergency shelter, and during earthquake mostly the tarpaulin shelters were built with poor structural integrity, health and sanitation facilities. The shelters were built in hustle and were very liable to get damage in extreme rainfall and wind. Although the transitional or temporary shelters were encouraging by providing basic resources such as bamboo and zinc sheets. For building a permanent house, the marginalized group suffered a lot with limited budget of local government to support them.

Key words: *Emergency shelter, earthquake, structural integrity, vulnerability*

1. INTRODUCTION

The mid-20th century saw the formalization of emergency shelter strategies, with increased involvement from international organizations and the development of guidelines to ensure minimum living standards. Advancements in materials science have introduced lightweight, durable, and weather-resistant materials, facilitating the rapid deployment of shelters. Additionally, modern shelters often incorporate modular designs, allowing for scalability and adaptability to various contexts [1].

In Nepal, the 2015 Gorkha earthquake exposed the vulnerability of emergency shelters to seismic events. Many temporary shelters, hastily constructed without adherence to seismic-resistant design principles, suffered significant damage or collapse during aftershocks. This highlighted the necessity for incorporating earthquake-resistant features into shelter designs, even for temporary structures [2].

Post-disaster assessments indicated that insufficient attention to local seismic hazards and the absence of appropriate engineering practices in shelter construction were critical factors leading to these structural failures [3]. These case studies underscore the imperative for rigorous engineering standards, quality materials, and adherence to seismic design principles in the construction of emergency shelters to mitigate the risk of structural failures during earthquakes. Post-disaster scenarios often involve damaged transportation networks, including roads, bridges, and airports, which impede the swift movement of relief supplies. In

Nepal, the complex topography and the destruction of key transport routes during the 2015 earthquake severely restricted access to affected communities, delaying the delivery of essential shelter materials and services [2].

2. MATERIALS AND METHODS

The research problem was identified, data were collected through primary and secondary survey and data were analysed and interrelated using RRI method.

2.1 Study area

The study area is Hetauda Sub Metropolitan Municipality of Makwanpur district, with the population of 193,576, according to the 2021 census. The city is located in Makwanpur District, Bagmati Province, Nepal. It has a population density of 740 people per square kilometer. The city is divided into 19 wards.



Fig. 2.1 Map of study area

2.2 Study Period

The study was conducted for six months during the period from January 2025 to end of July 2025.

2.3 Sampling Technique, Sampling Size and Data Collection

Convenience and purposive sampling technique were used for collecting data. Primary data was collected from in-depth interview, field observation, focused group discussion and questionnaire survey. A target of 156 respondents were made from the study area. However, 155 respondents participated in the study.

Similarly, secondary data were collected through published journal articles e-book, government database and annual reports.

The sample size was fixed using Slovin's equation which is as follows:

$n = N/(1+Ne^2)$ Where,

n = sample size required

N = total actual sample size of the study area = 1,35,000 (Approx)

e = permissible error taken. (Generally taken as 5-10%)

Ward No: 1, 2, 4, 5, 6, 7, 8, 10 were considered for the sampling

$e = 8\%$

Then,

$n = N/(1+Ne^2) = 156$

There were 155 valid respondents.

2.4 Data Analysis and Interpretation

Primary data was collected from different tools and technique. The collected data was further arranged and analyzed in MS tool, excel. The results obtained from the study were presented in tables, graphs, pie charts and interpreted later. The questions developed using likert 5-point scale was analyzed using the formula of RII (Relative Importance Index). In this research, Likert 5-point scale was used to determine relative importance index (RII) for the desirable cause and effects and possible solutions to assist the willingness of farmers in agritourism development.

The value of RII is given by the equation:

$$\begin{aligned}\text{Relative Importance Index (RII)} &= (\sum W)/AN \\ &= (5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1)/5N\end{aligned}$$

Where, W = weight to each factor by the respondent ranging from 1 to 5

n_1 = number of respondents who strongly disagree

n_2 = number of respondents who disagree

n_3 = number of respondents who moderately agree

n_4 = number of respondents who agree

n_5 = number of respondents who strongly agree

A = highest weight i.e. 5 in this study

N = total number of respondents

The relative importance index (RII) ranges from 0 to 1.

3. RESULTS AND DISCUSSIONS

3.1 Results of Respondents

3.1.1 Education level of the respondent

As shown in the Fig. 4.3, out of 155 respondents 41% have completed bachelor's level of education followed by 23% have completed master's level of education. Similarly, 18% each have completed higher secondary and secondary level of education.

3.1.2 Characteristics of the respondents

As shown in the Fig. 4.4, 58 of the total respondents were active community people followed by 30 of them were political representatives. Similarly, 21 each were municipal officers and non-profit members. Additionally, 9 of them were municipal sub-engineers, 8 of them were municipal engineers and only 7 of them were contractor.

3.1.3 Major problem in emergency shelter in the Hetauda municipality

As shown in the Fig. 4.5, the major problems associated with emergency shelter with the highest RII value of 0.79 is "Space limitation in urban areas for shelter building" followed by "Limited time and hustle during construction" followed by "Delay in delivery of shelter materials" and "Poor quality control on construction materials" both with the same RII value of 0.78. Similarly, "Poor governance in disaster preparedness, response and recovery", "Delay in funding of construction materials", "Psychological and health challenges" and "Overcrowded and poorly managed shelters" all with the same RII value of 0.76. Additionally, other problems associated with emergency shelter in post disaster recovery within the municipality are "Structural vulnerabilities and weakness in shelter", "Weak national reconstruction agency", "Inappropriate land use planning", "Social biasness, inequalities and tensions" and "Inadequacy of temporary shelters to meet long term needs", all with the same RII value of 0.75. Apart from this, other important problems are "Ecological and environmental problems", "Logistical and resource constraints", "Corruption and bureaucratic inefficiencies" and "Insufficient attention to local seismic hazards" with the RII values ranges between 0.74-0.73.

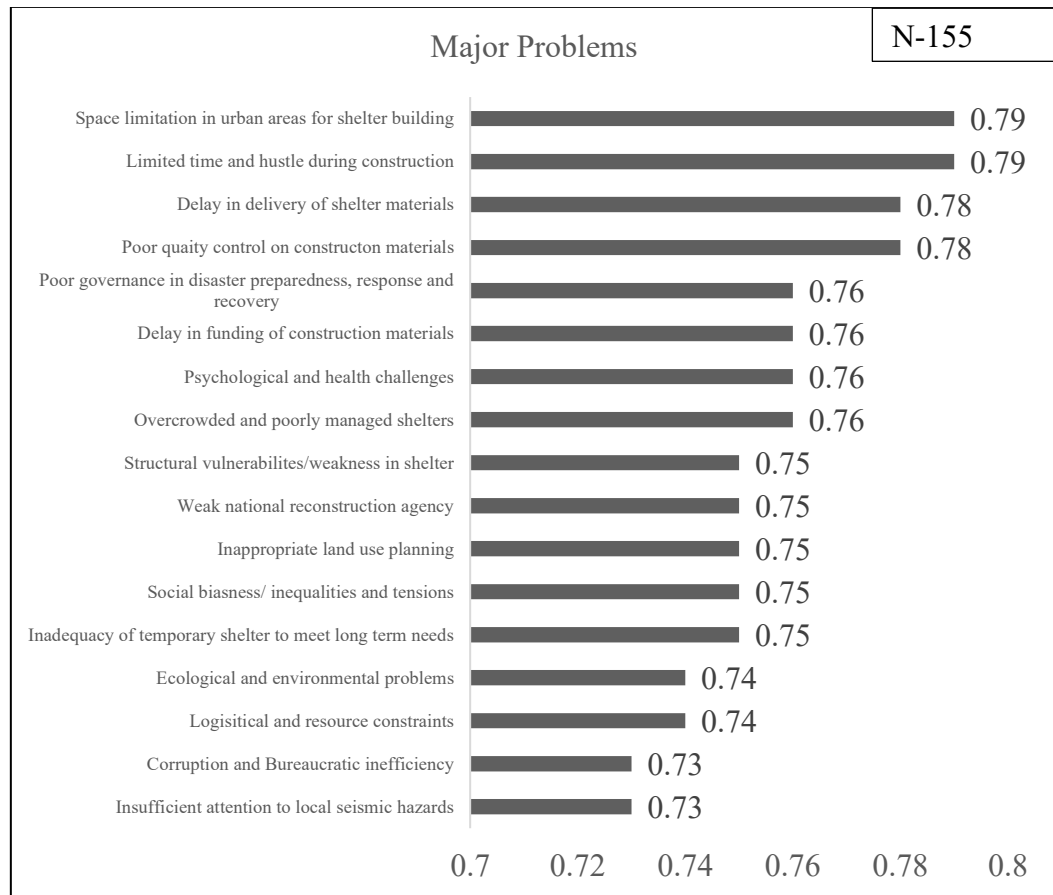


Fig.: 3.3 Major problems in emergency shelter

3.1.4 Causes and effects of space limitation in urban areas for shelter building

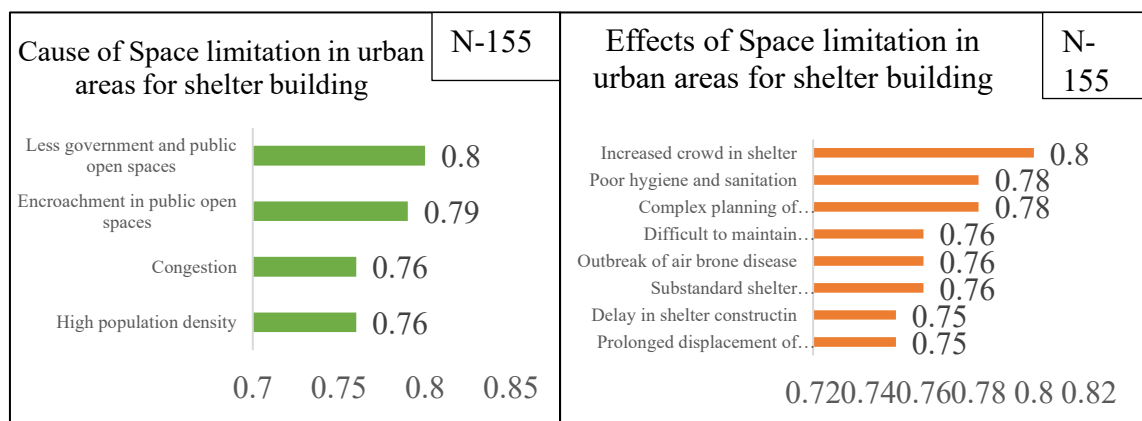


Fig. 3.4. Causes and effects of space limitation in urban areas for shelter building

3.1.5 Causes and effects of structural vulnerabilities/ weakness in shelter

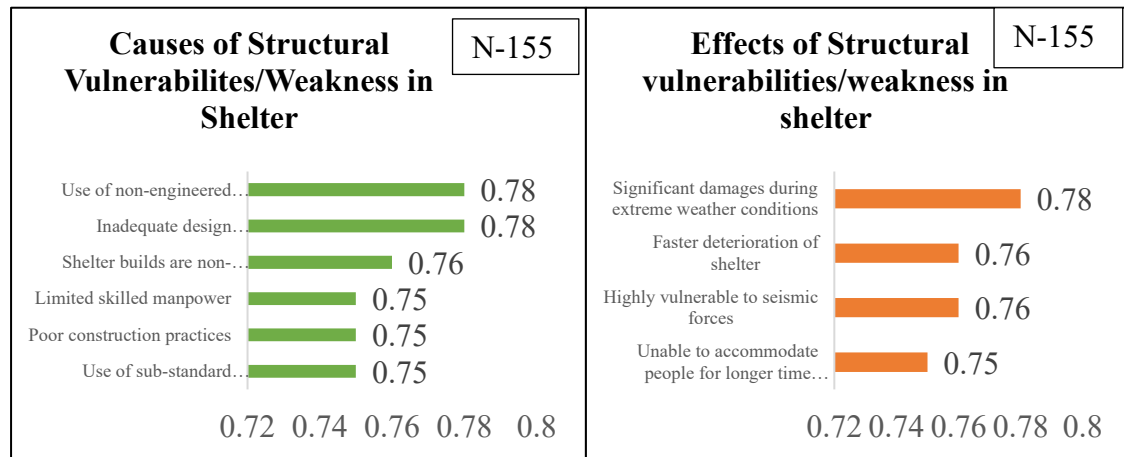


Fig. 3.5. Causes and effects of structural vulnerabilities/ weakness in shelter

3.1.6 Causes and effects of logistical and resource constraints

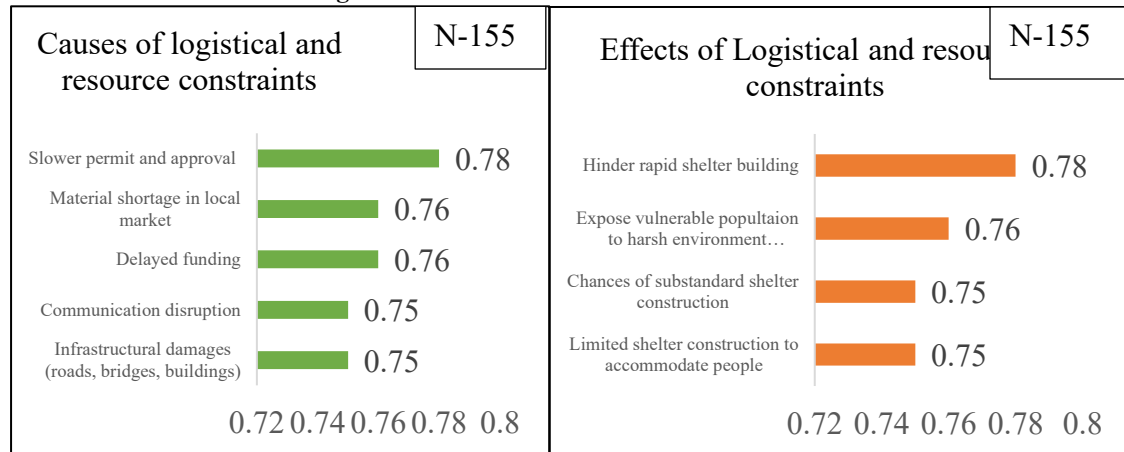


Fig. 3.6. Causes and effects of logistical and resource constraints

3.1.7. Causes and effects of limited time and hustle during construction

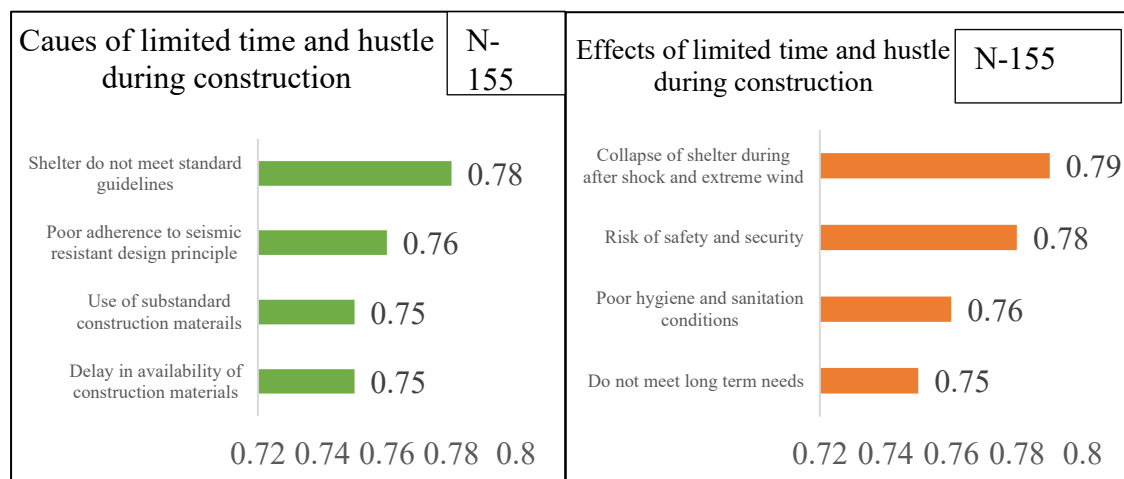


Fig. 3.7. Causes and effects of limited time and hustle during construction

3.1.8 Causes and effects of poor-quality control on construction materials

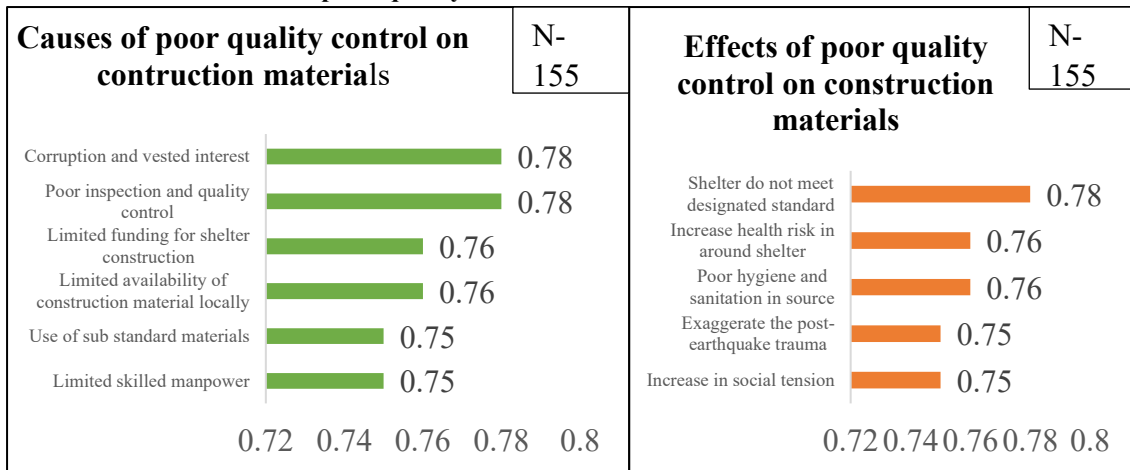


Fig. 3.8. Causes and effects of poor-quality control on construction materials

3.1.9 Causes and effects of insufficient attention to local seismic hazard

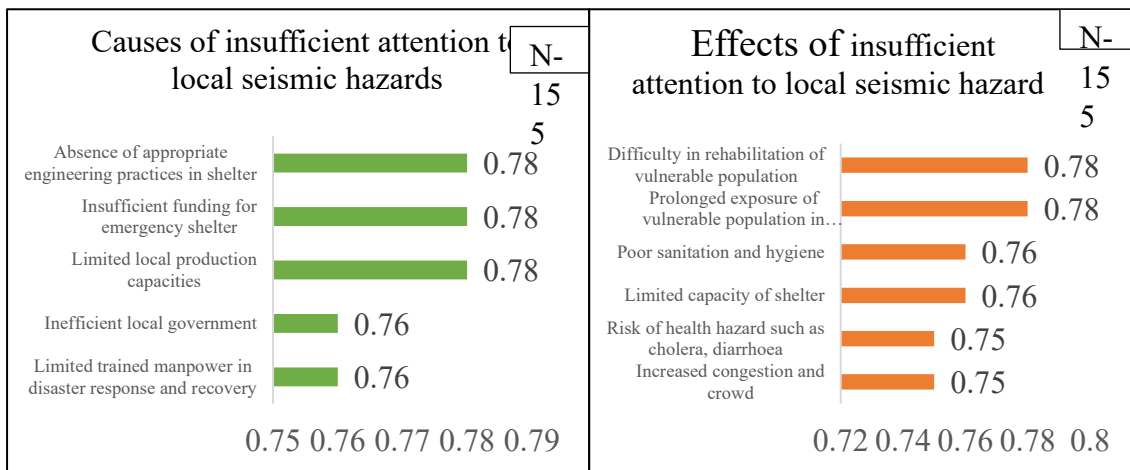


Fig. 3.9. Causes and effects of insufficient attention to local seismic hazard

3.1.10 Causes and effects of delay in delivery of construction materials

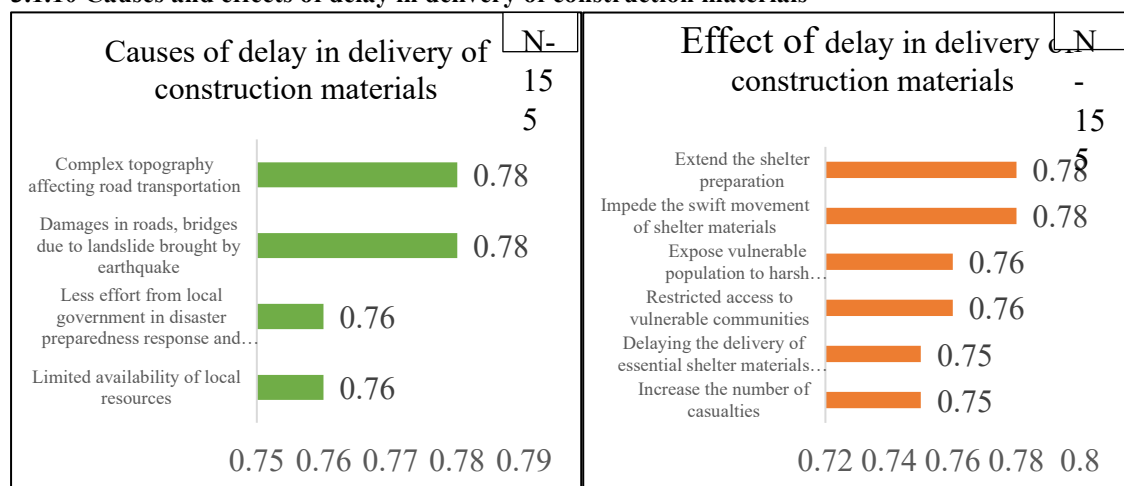


Fig. 3.10. Causes and effects of delay in delivery of construction materials

3.1.11 Causes and effects of psychological and health challenges

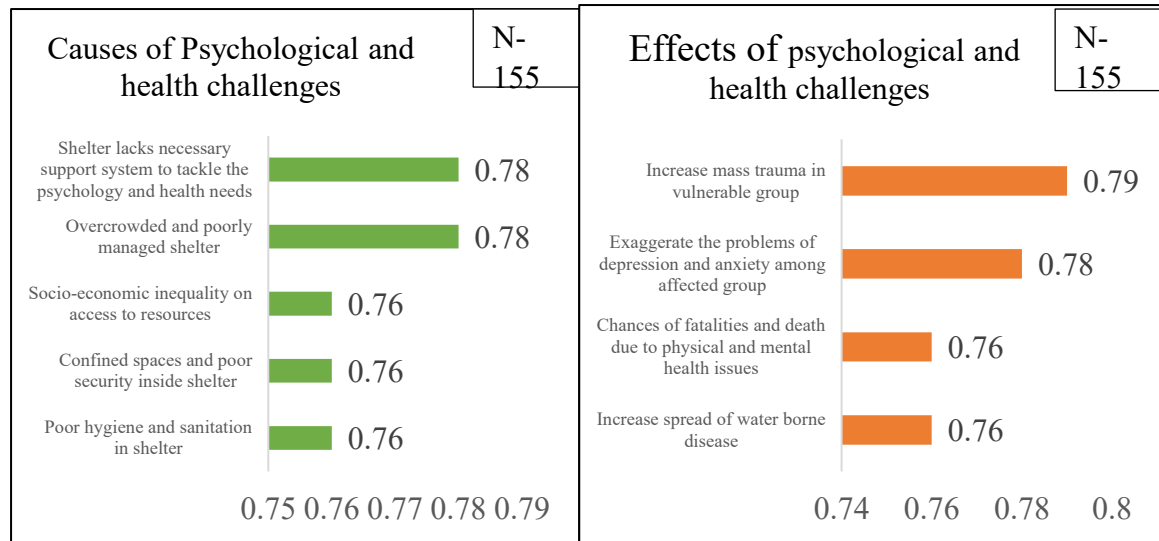


Fig. 3.11. Causes and effects of psychological and health challenges

3.1.12 Causes and effects of delay in funding of construction materials

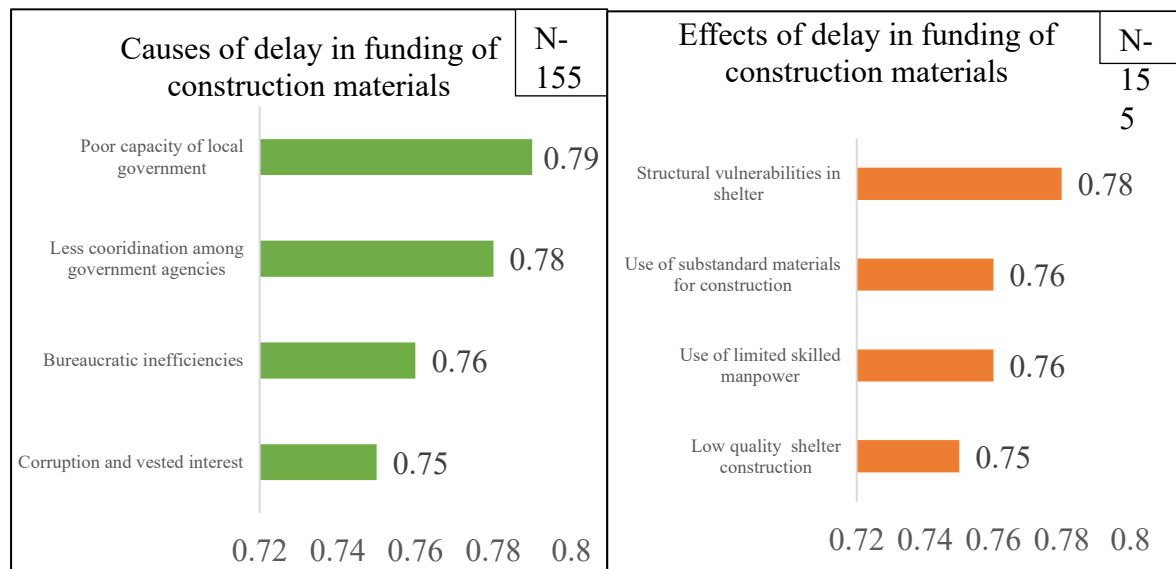


Fig. 3.12. Causes and effects of delay in funding of construction materials

3.1.13 Causes and effects of overcrowded and poorly managed ventilation

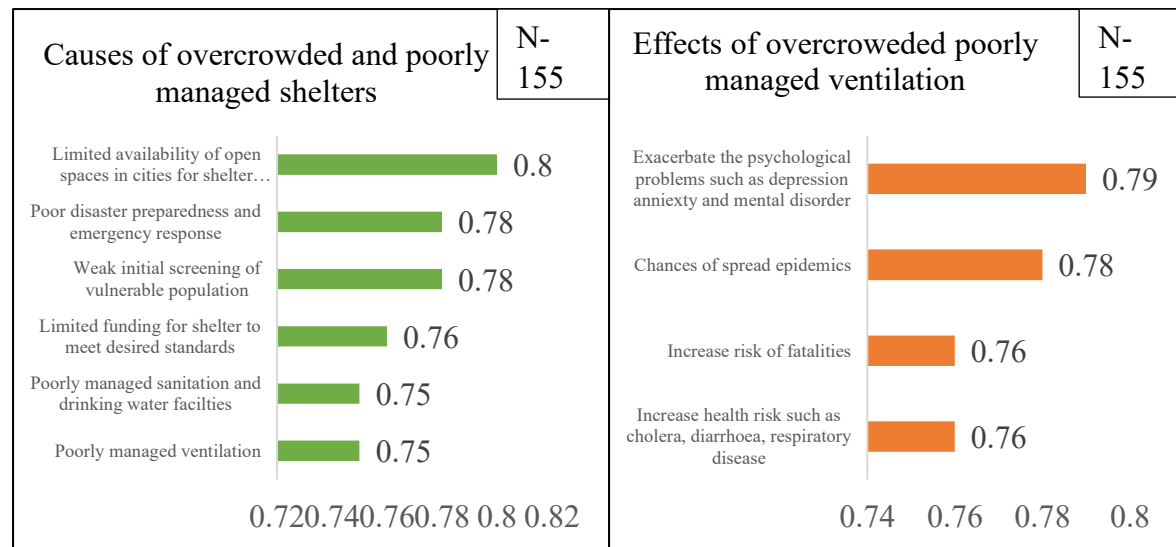


Fig. 3.13. Causes and effects of overcrowded and poorly managed ventilation

3.1.14. Causes and effects of corruption and bureaucratic inefficiency

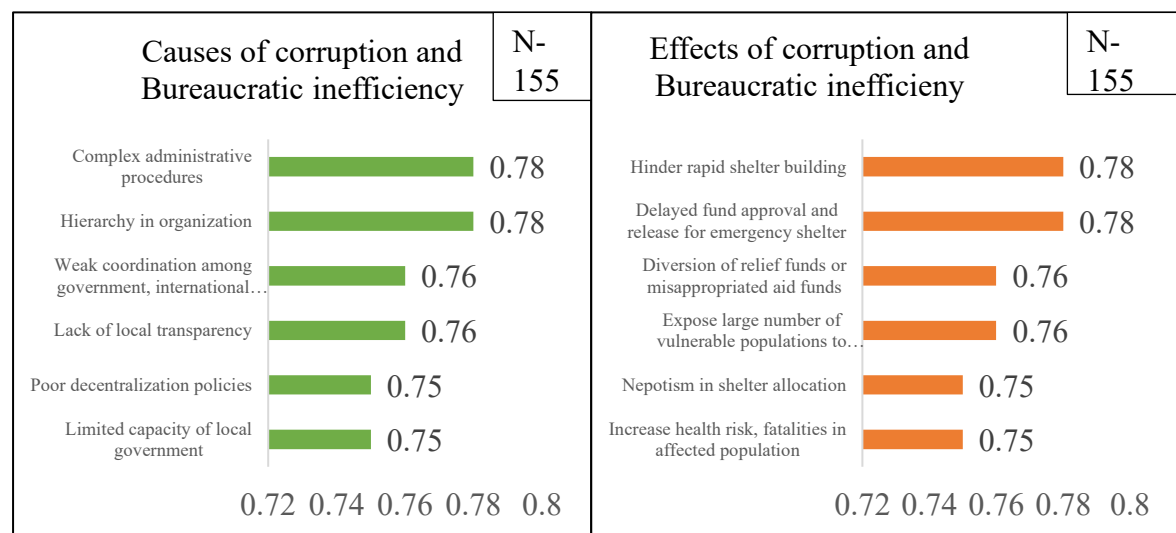


Fig. 3.14. Causes and effects of corruption and bureaucratic inefficiency

3.1.15 Causes and effects of inadequacy of temporary shelters to meet long term needs

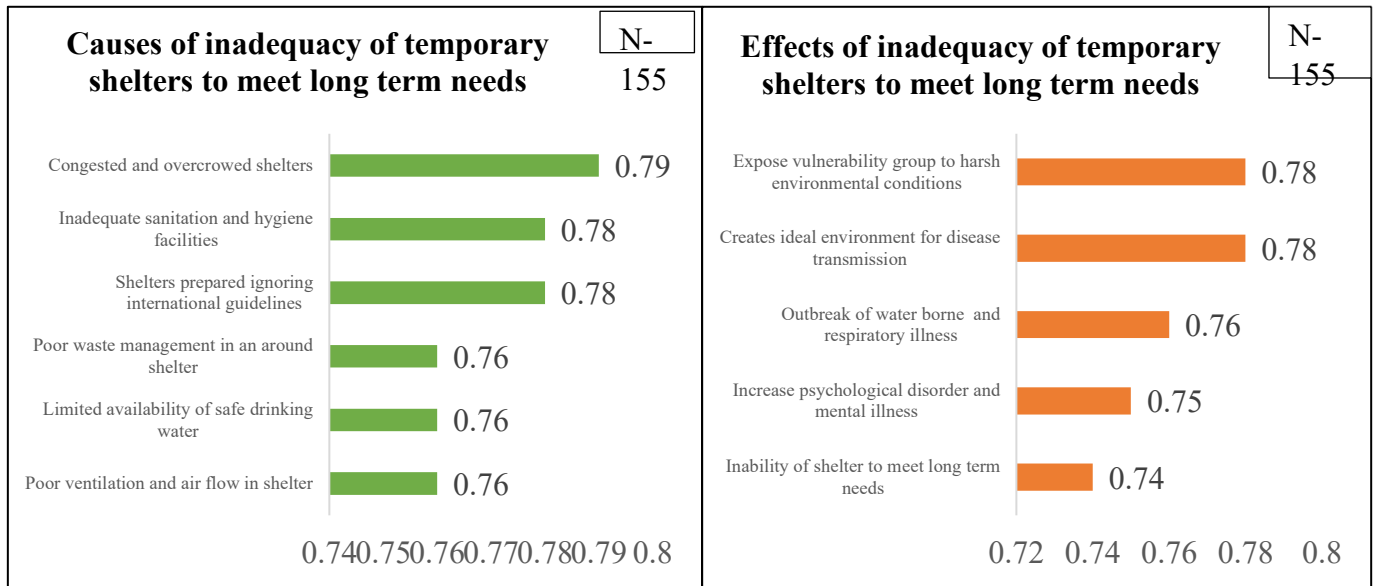


Fig. 3.15. Causes and effects of inadequacy of temporary shelters to meet long term needs

3.1.16 Causes and effects of social biasness/ inequalities and tensions

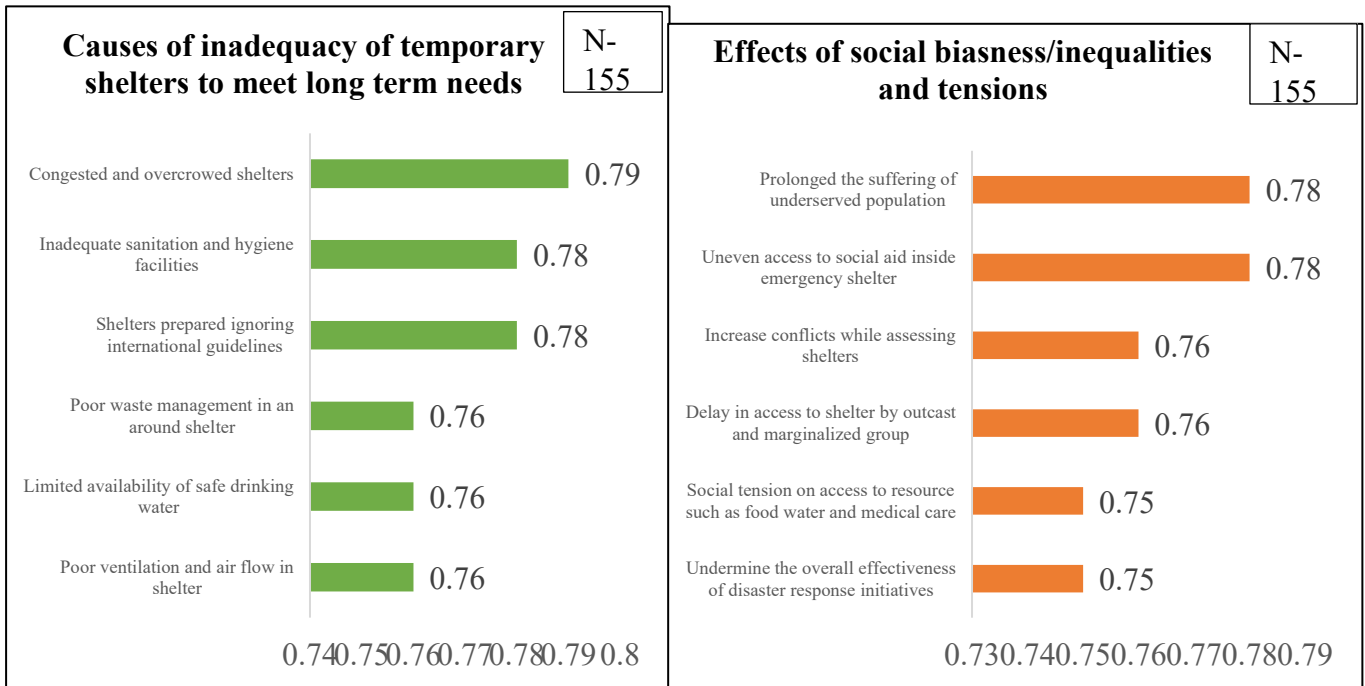


Fig. 3.16. Causes and effects of social biasness/ inequalities and tensions

3.1.17 Causes and effects of ecological and environmental problems

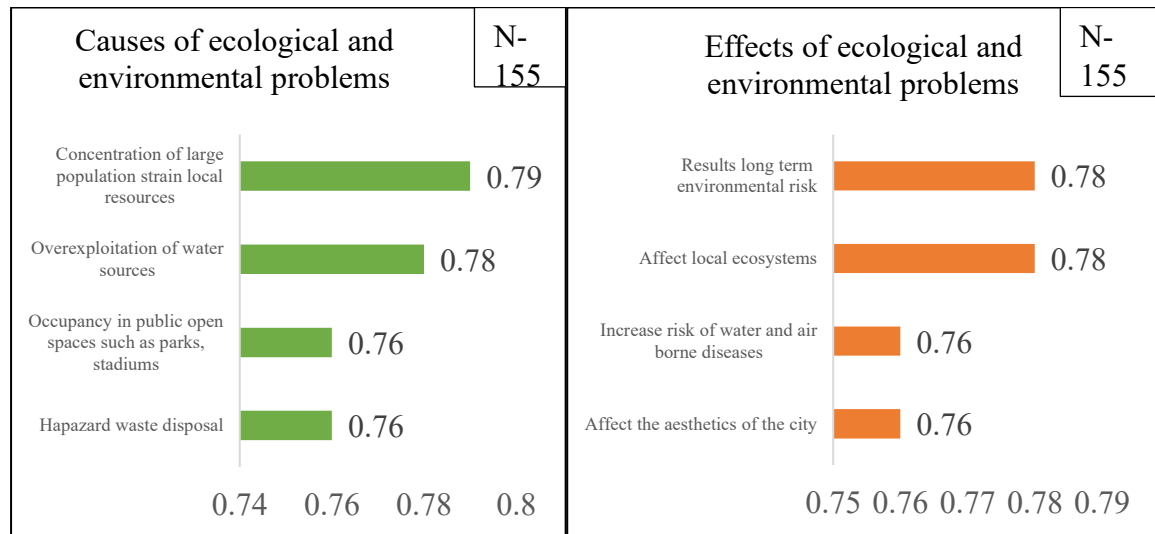


Fig. 3.17. Causes and effects of ecological and environmental problems

3.1.18 Causes and effects of poor governance in disaster preparedness response and recovery

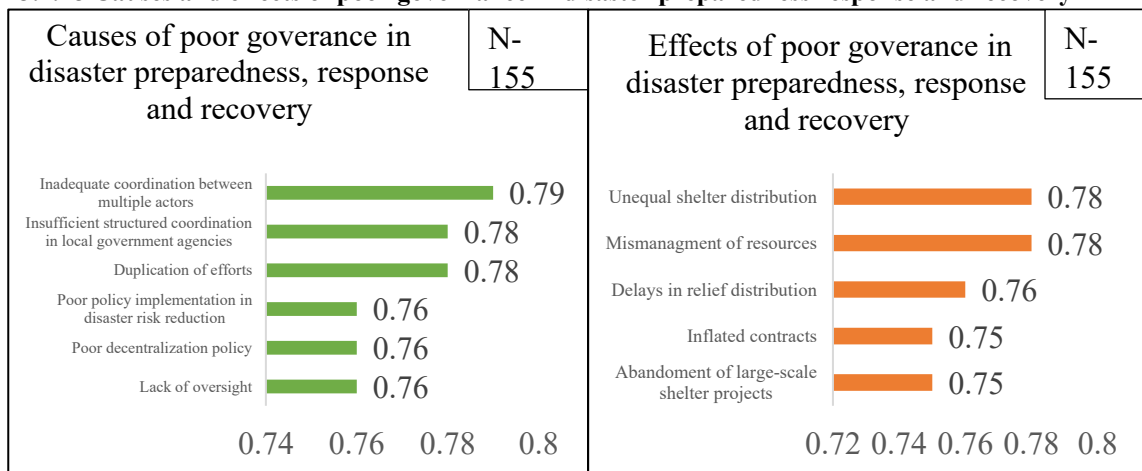


Fig. 3.18. Causes and effects of poor governance in disaster preparedness response and recovery

3.1.19 Causes and effects of space limitation in urban areas for shelter building

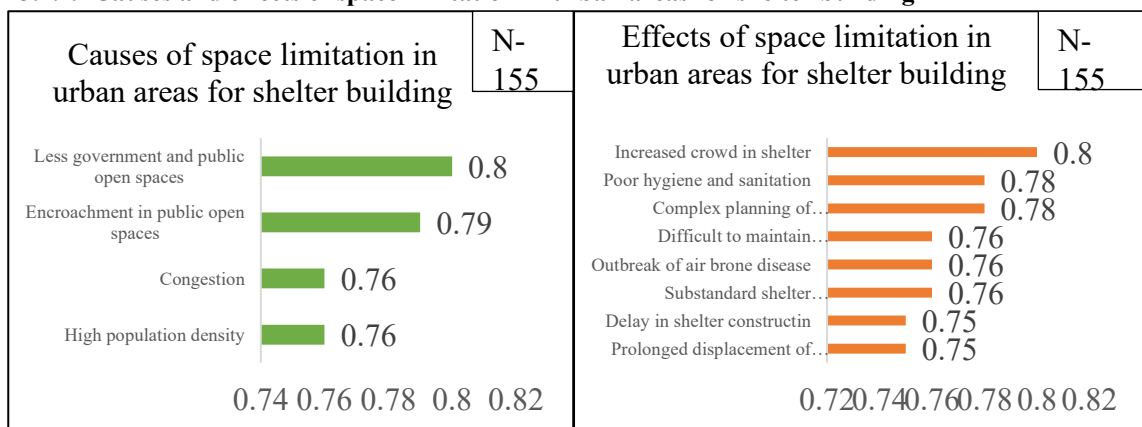


Fig. 3.19. Causes and effects of space limitation in urban areas for shelter building

3.1.20 Causes and effects of inappropriate land use planning

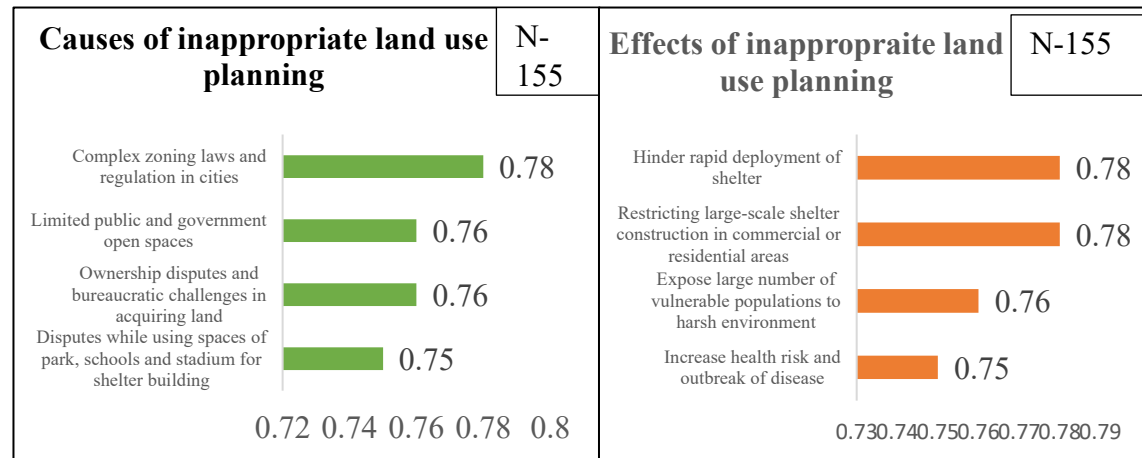


Fig. 3.20. Causes and effects of inappropriate land use planning

3.1.21 Causes and effects of weak national reconstruction agency

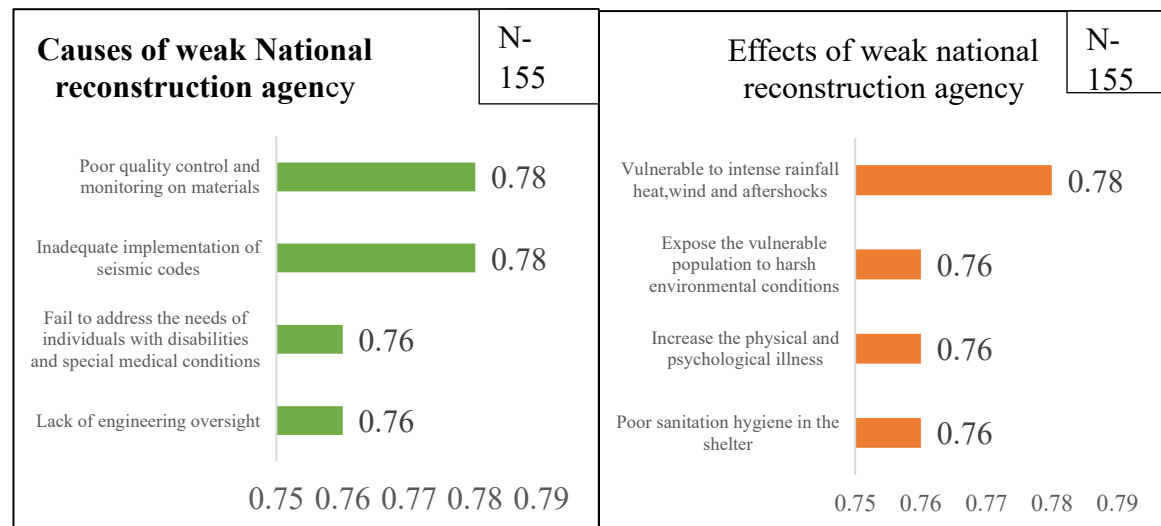


Fig. 3.21. Causes and effects of weak national reconstruction agency

3.1.22 Mitigating measures to overcome the problems

As shown in the Fig. 4.39, one of the major mitigating measures to overcome the problem associated with emergency shelter within Hetauda municipality during disasters like earthquake with the highest RII value of 0.8 are “Consideration of vulnerabilities and implementing transparent as well as need-based system” and “Strict guidelines on rigorous engineering standards, quality materials and adherence to seismic design principles”. Similarly, “Adopt community based accountability measures involving communities in shelter planning, construction, monitoring and aid distribution”, “Provision of robust policy framework , strong coordination among stakeholders, transparency to prevent financial management, “Adopt effective local leadership and maintaining orders and promoting social integration within emergency shelter”, “Adopt financial tracking, independent audit and community monitoring mechanism to avoid mismanagement of fund and corruption” and “Integrating mental health support environment through psychological counselling to the affected individuals in shelter” all with the same RII value of 0.76. Apart from this, “Strengthen National reconstruction authority to guide seismic building efforts”, “Strengthening anti-corruption policies by enforcing by enforcing clear laws against misuse of disaster funds” and “Utilizing stringent locally sourced renewable and eco-friendly materials to reduce the environmental impact of earthquake” are important

solutions with the RII value of 0.75 to overcome the problems. In addition to these, “Application of prefabrication and modular construction techniques”, “Effective collaboration between international agencies, national government and community organization”, “Strengthening national government in establishing disaster relief laws” and “Implementing building regulations that provide valuable insights to earthquake resistant shelter design” are other solutions for efficient emergency shelter management during disaster like earthquake.

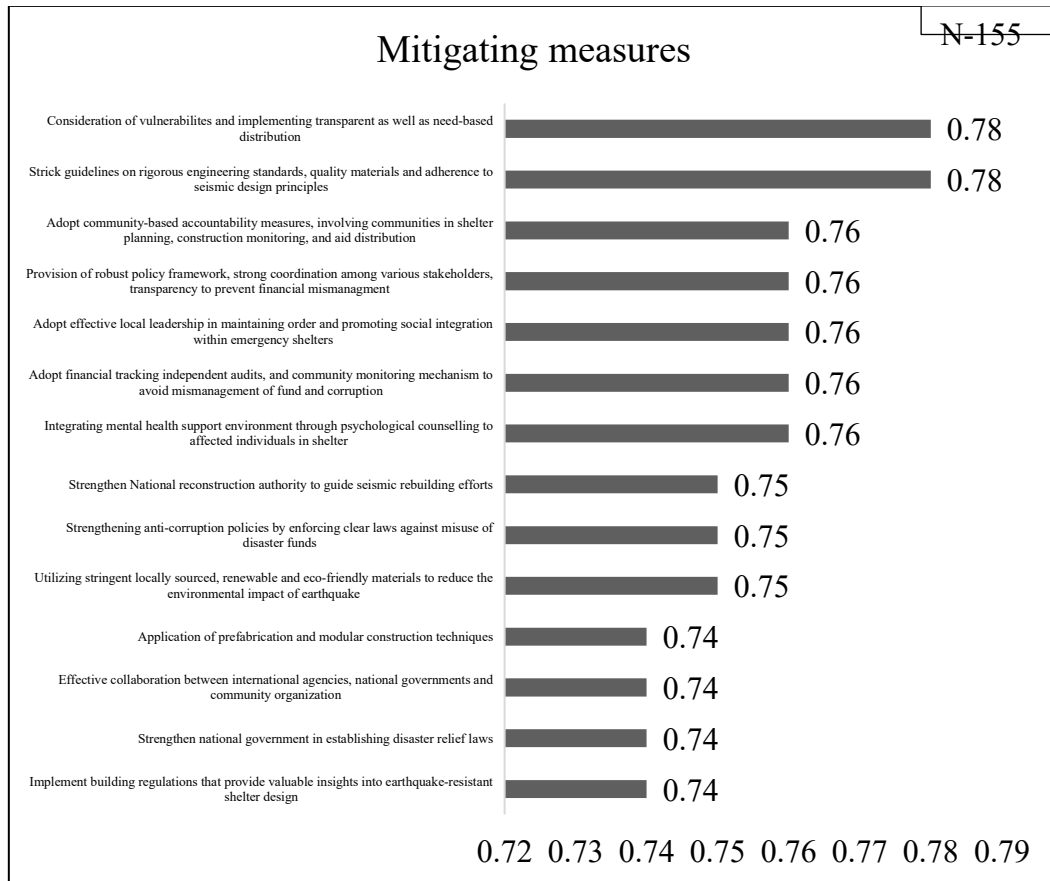


Fig. 3.6 Mitigation measures to overcome the problems

3.2 Discussions

3.2.1 Findings from field observation

On field observation during the study, within the municipality, it is clear increasing urbanization, ongoing encroachment in the government, public open spaces, river banks etc it is difficult to manage space for emergency shelter building during the disaster. There are limited parks and recreation spaces in close city proximity, so in case of disaster the municipality face challenges in managing and accommodating vulnerable people in the shelter. The encroachment and illegal construction are also limiting the open spaces, hence congestion in shelter will be the major problem in the future.

3.2.2 Findings from in-depth interview

On in-depth interview with the urban planners, municipal engineer and disaster response officers from non-government organization, it is clear that in the past earthquake of 2012, in absence of proper planning and resources on disaster preparedness, response and recovery, the local government have to face huge problem in accommodating vulnerable population in the emergency shelter. In absence of skilled human resources, shelter building materials, enough budget plan, vulnerable people were exposed to harsh environmental conditions for long time. The emergency shelter and spaces for building is itself a challenge because of limited open spaces within the municipality. The affected communities were those who were in traditional houses

with limited earthquake resistance in building, likely to collapse during earthquake. The poorly constructed building is also the reason for higher vulnerable population. Limited awareness, alertness among the communities is also driving fatalities during earthquake. Poor earthquake monitoring and early warning is another reason for higher mishap during the disaster. Also, the psychological and social tension among people is also high during, that have exacerbated the problem. Hence it is necessary to aware communities on disaster resilient, early warning consideration, and trained communities on mobilization of locally available resources on shelter building, following strict guidelines on building earthquake resistant houses, along with limiting encroachment in public and government spaces to secure and easily rehabilitate vulnerable people during disaster. Also, mental health counselling is also important for communities to recover them from trauma.

3.2.3 Findings from focused group discussion

On focused group discussion with the political representative, active community people, contractor and urban planners, it is clear that, there is limited effort made by the local government to make collaboration with provincial, national and other non -profit organization in collaborative effort for rehabilitation and shelter buildings. As there are limited plans for disaster preparedness, response and recovery during earthquake. Apart from this, increasing urbanization, limited open spaces and encroachment in open spaces, have made space limitation for developing emergency shelter within the municipality. Even the communities are also not trained in self-protection during the disaster. In earthquake of 2012, the weakness of municipality to rehabilitate vulnerable community building emergency was slow, as many of them were exposed to harsh environmental conditions for longer period of time. The mental illness among affected people is also high. Hence it is necessary to work on disaster preparedness, response, recovery by municipality, so that building emergency shelter will be faster, utilizing locally available resource, training communities, as such it helps in faster recovery of affected individuals.

3.3 Comparison of findings with the past studies

Table 4.1. Comparison of findings with past studies

S.N	Past study and its findings	Findings from this study
1	In Nepal, the complex topography and the destruction of key transport routes during the 2015 earthquake severely restricted access to affected communities, delaying the delivery of essential shelter materials and services [2]	Hetauda city also faced similar problem of delay in delivery of shelter material due to complex topography.
2	In contrast, locally sourced materials such as bamboo and rammed earth are more cost-effective but may lack durability or require additional treatment to meet safety standards [4].	People of hetauda tends to use prefabricated material for shelter construction due to sustainability and cost friendly reason.
3	Kathmandu faced a severe shortage of safe open spaces to accommodate displaced populations, leading to makeshift shelters in streets, parks, and public buildings [5].	Hetauda also faced similar problem: lack of open space for emergency shelter.
4	Corruption and bureaucratic inefficiencies pose significant threats to emergency shelter governance, leading to diversion of relief funds, nepotism in shelter allocation, and construction delays [6].	In context of hetauda, corruption and bureaucratic inefficiencies are not serious issues as compared to other problems
5	This highlighted the necessity for incorporating earthquake-resistant features into shelter designs, even for temporary structures [2]	where our mitigation measures also state its importance

4. CONCLUSIONS

The comprehensive analysis from field observation, in-depth interview, focused group discussion and questionnaire survey, it is clear that the emergency shelter building within the hetauda municipality is not efficient in earlier disasters like earthquake. The Space limitation in urban areas for shelter building and limited time and hustle during construction followed by delay in delivery of shelter materials is creating the problems. The poor governance in disaster preparedness, response and recovery is one of the major reasons that is delaying funding of construction materials. Apart from the psychological and health challenges among affected individuals is evident. Due to overcrowded and poorly managed shelters along with poorly managed sanitation has exacerbated the problem. Additionally, other the impact of earthquake has been higher because of residential build traditionally without building codes and guidelines. All these have increased the impact of earthquake. Similarly, the structural vulnerabilities in emergency shelter is another problem as, shelter are easily destroyed by strong wind, heavy rainfall and earthquake aftershocks. The biasness among outcast and marginalized group is also common while acquiring shelters as it is much pronounced in many developing countries like Pakistan, Bangladesh and Haiti. The political influence is also common within the affected group. Hence it is necessary for effective collaboration of municipal with provincial and national government to prepare effective disaster preparedness, response and recovery plan followed by training communities on self-protection in disaster followed training people on building earthquake resistant emergency shelter using locally available resources. It is necessary for government to allocate enough budget on disaster response and recovery, followed by provision of early warning system among communities using mass media, internet to minimize the impact of disaster like earthquake.

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