EARTHQUAKE RISK REDUCTION AND MANAGEMENT: A CASE STUDY OF 2023 BAJHANG EARTHQUAKE, NEPAL

A Thesis Submitted to
APF Command and Staff College,
Faculty of Humanities and Social Sciences, Tribhuvan University
In Partial Fulfillment of the Requirements
for the Degree of Master of Security, Development and Peace Studies

Submitted By

LOKENDRA DEV BHATTA

Eight Batch (2079/2081)

Roll No.: 28MSDPS40053

TU Registration No.:6-1-327-242-96

APF Command and Staff College

Sanogaucharan, Kathmandu, Nepal

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DECLARATION

I, LOKENDRA DEV BHATTA declare that this thesis entitled **EARTHQUAKE RISK REDUCTION AND MANAGEMENT: A CASE STUDY OF 2023 BAJHANG EARTHQUAKE, NEPAL** submitted to APF Command and Staff College is my own original work unless otherwise indicated or acknowledged in the thesis. The thesis does not contain materials which has been accepted or submitted for any other degree at the University or other institution. All sources of information have been specifically acknowledged by reference to the author or institution(s).

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LETTER OF RECOMMENDATION

This thesis entitled **EARTHQUAKE RISK REDUCTION AND MANAGEMENT: A CASE STUDY OF 2023 BAJHANG EARTHQUAKE, NEPAL** has been prepared by LOKENDRA DEV BHATTA under my guidance and supervision. I hereby recommend it in partial fulfillment of the requirements for the Degree of Master of Security Development and Peace Studies for final examination.

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Thesis Supervisor

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LETTER OF APPROVAL

This Thesis entitle **"EARTHQUAKE RISK REDUCTION AND MANAGEMENT: A CASE STUDY OF 2023 BAJHANG EARTHQUAKE, NEPAL"** submitted by **LOKENDRA DEV BHATTA** to APF Command and Staff College, Faculty of Humanities and Social Sciences, Tribhuvan University in partial fulfillment of Master Degree in Security, Development and Peace Studies has been approved by the undersigned members of the Evaluation Committee.

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Lokendra Dev Bhatta

2081/02/16

ABSTRACT

Earthquake is considered as one of the most recurring and common disaster in Nepal. Nepal is known to be the eleventh most earthquake vulnerable country in the world for earthquake vulnerability. This study focuses on the disaster risk reduction management aspects of the 2023 Bajhang earthquake which tries to identify the key factors that contribute the vulnerability including geographic condition, infrastructure, and building coding systems, awareness, socioeconomic circumstances, and participation in DRR activities. The purpose of this study was to analyze the preparedness before earthquake, causes of earthquake and initiative taken by the government after the earthquake. The qualitative method is used to prepare this research paper. This study is based on thematic analysis. The primary data were collected through different techniques such as questionnaires, Key Informant Interview (KII), and focus group discussions (FDG). Ninety respondents were participated in this study. The key finding of lack of awareness before earthquake, the local government did not formulate DRR strategy to cope with disaster, most of the mud and stone building were completely damage rather than concreate hocuses. The damage were mostly occurred in low level of socio economic condition areas. The neighbors were the first responder in the society during the earthquake. The main causes of earthquake lose and damage is haphazardly using dozer, geographical condition, lack of awareness, poor socio-economic condition, and absence of law after the post-earthquake scenario people were more awareness than before, better coordination and collaboration between stakeholders, lack of stoke ration, and other basic necessary things. The purpose solution to the urgent need is to initiate the reconstructive the damaged buildings and complete them coming the onset of the next monsoon. The government have to be come up with short and long term plan for cope with disaster situation near future. The disaster was a results of human induced factors which are most prevalent in society. Capacity building of local community and security forces and prepare for future in the coordination of three tier of government.

Keywords: Earthquake, vulnerability, preparedness, community, preventive measures.

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LIST OF ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
AEQ	After the Earthquake
ANC	Antenatal care
APEC	Asia-Pacific Economic Cooperation
ARI	Acute Respiratory Infection
BEQ	Before the Earthquake
BFI	Banking, Finance, Insurance and Securities
CBO	Community-Based Organization
CBS	Central Bureau of Statistics
CDC	Community Development Center
CDCF	Child Development and Concern Foundation
CDO	Chief District Officer
CDPS	Central Department of Population Studies
CDRC	Central Disaster Relief Committee
CEO	Chief Executive Officer
DDC	District Development Committee
DDRC	District Disaster Relief Committee

DFID	Department for International Development of United Kingdom
DPNet-Nepal	Disaster Preparedness Network
DRR	Disaster Risk Reduction
DRRC	Disaster Risk Reduction Committee
ECHO	Humanitarian Aid Department of the European Commission
EOCS	Emergency Operations Centers
EOI	Expression of Interest
EQ	Earthquake
FAO	Food and Agriculture Organization
FGD:	Focus Group Discussion
GDP:	Gross Domestic Product
GFDRR	Global Facility Disaster Reduction and Recovery
GLOF	Glacial Lake Outburst Flood
GNP	Gross National Product
GPS	Global Positioning System
I/NGO	International/ Non-Governmental Organization
IASC	International Accounting Standards Committee
ICIMOD	International Centre for Integrated Mountain Development

IFRC	International Federation of Red Cross
IFRC	International Federation of Red Crescent Cross Society
ISOT	International Search and Operation Teams
JICA	Japan International Cooperation Agency
KII	Key Informants Interview
MOF	Ministry of Finance
MOHA	Ministry of Home Affairs
MOPH	Ministry of Population and Health
MPI	Multidimensional Poverty Index
Mw	Movement magnitude
NA	Not available
NFIP	National Flood Insurance Program
NHRC	National Human Rights Commission
NPC	National Planning Commission
NRA	Nepal Reconstruction Authority
PDNA	Post Disaster Need Assessment
PLWDs	People Living with Disabilities
PTSR	Profound Post-Traumatic Stress Reactivity

RRP	Rehabilitation and Recovery Plan
NRs	Nepalese Rupees
RUDEK	Rural Development and Empowerment Center
SAARC	South Asian Association for Regional Cooperation
SAR	Search and Rescue
TU	Tribhuvan University
UNFPA	United Nations Population Funds
UNICEF	United Nations Children's Fund
UNISDR	United Nations Office for Disaster Risk Reduction
USD	United States Dollar
WASH	Water, Sanitation, and Hygiene
WFP	World Food Program
WHO	World Health Organization

CHAPTER I

INTRODUCTION

The context of the investigation is established in this chapter. It outlines the goals and challenges of the study. Analyzing disaster risk reduction (DRR) efforts in Bajhang prior to the 2023 earthquake, as well as the reasons behind losses and the actions done by various stakeholders following the earthquake, is the main thrust of this study. The efficacy of these projects can be determined by researchers through analysis. In disaster mitigation, the story may highlight the importance of community involvement and context-specific solutions. Investigating the cause of the Bajhang earthquake damage is essential. Building materials and local infrastructure are among the subjects that researchers can look into. Assessing the efficiency of catastrophe DRR response during the 2023 Bajhang earthquake is critical. Researchers can assess factors like timeliness, coordination, and community resilience. The argument could underline the importance of adaptable methods that consider the local context as well as learning from prior disasters.

1.1. Background

Far Western Nepal was hit by a series of earthquakes On October 3, 2023, a series of earthquakes struck Nepal's Bajhang district. The first earthquake, measuring 5.3 Mw, was recorded at 2:40 pm, with its epicenter in Talkot, Bajhang.at least 12 shocks of 5.0 to 6.3 Mw in 15 hours. There were over 1000 aftershocks of less than Mw 4.0 within a week, which are not listed in this report. Seven districts viz. Bajhang, Bajura, Baitaidi, Dadeldhura, Achham, Darchula, and Doti were affected by earthqauake of which Bajhang and Bajura were the most affected district. One person lost her life in an earthquake-induced landslide in Bajhang and 34 others were injured of which 25 were from Bajhang, 5 from Achham, 2 from Baitadi, and 2 from Doti district. The earthquake mainly affected buildings, most of them private houses (Sharma, 2023). As per reports prepared by the local governments, 3598 private houses were completely damaged (i.e. severely affected) and 11,280 were partially damaged in the affected seven districts. Bajhang sustained most of the damages: 2906 houses completely and 6140 houses partially, followed by Bajura where 678 houses were completely damaged and, other

5092. This data have yet to be technically verified. 124 government buildings, mostly schools, were completely damaged of which 123 are in Bajhang and one in Achham. Other 205 government buildings are partially damaged of which 152 are in Bajhang, 28 in Bajura, 14 in Baitadi, 9 in Achham, and 2 in Darchula districts. While some sections of roads were blocked for a few hours due to landslides, there was no significant disruption in lifelines such as electricity, water, telecommunication, and other services. A few livestock were reported dead, and a few others were injured. Most people, including schools, managed to rescue themselves and brought students to safety. Regarding human casualties, fortunately, the count is lower than could have been (Aryal, 2024).

This is possibly due to a foreshock of Mw 5.2 that struck 26 minutes before the second hit of Mw 6.3, which caused the most physical damage. Urgent need for temporary shelters for those whose houses were completely damaged. Humanitarian agencies have fulfilled needs with temporary shelter kits including some more essentials like food. However, food and utensils were not significantly damaged except for one school. No camps are required to be established as the affected families have managed temporary shelters at their foregrounds. A similar situation was in the case of water, food, fuel, and other materials that would be required if people were shifted to camps (Neupane, 2024).

The earthquake in 2023 highlighted the vulnerability of the region to seismic events and emphasized the importance of preparedness and implementing cost-effective indigenous methods like bamboo retrofitting and open jointed stone masonry to mitigate the impact of future

According to the National Earthquake Monitoring and Research Centre (NEMRC), the region suffered over a thousand aftershocks following the large earthquakes on October 3. Many of them had magnitudes less than 4.0. Table 1 lists the major earthquakes that occurred in the region between October 3 and 12, 2023.

Table 1

Major Earthquakes (above 4.0 magnitude)

Date	Time	Latitude	Longitude	Rector Scale	Place
26/06/2080	1:51	29.49	81.25	5.0	Bajhang
26/06/2080	00:31	28.48	83.21	4.4	Baglung
25/06/2080	00:22	29.61	81.19	5.2	Bajhang
20/06/2080	12:32	29.61	81.24	4.3	Bajhang
18/06/2080	22:51	29.60	81.23	4.5	Bajhang
17/06/2080	05:43	29.63	81.20	4.3	Bajhang
17/06/2080	04:27	29.41	81.26	4.3	Bajhang
17/06/2080	00:50	29.65	81.19	4.3	Bajhang
17/06/2080	00:16	29.62	81.27	4.1	Bajhang
16/06/2080	17:38	29.65	81.27	5.0	Bajhang
16/06/2080	17:19	29.56	81.16	5.0	Bajhang
16/06/2080	16:31	29.53	81.14	4.3	Bajhang
16/06/2080	16:28	29.59	81.28	4.1	Bajhang
16/06/2080	15:45	29.58	81.10	4.1	Bajhang
16/06/2080	15:13	29.55	81.18	5.1	Bajhang
16/06/2080	15:06	29.59	81.19	6.3	Bajhang
16/06/2080	14:40	29.64	81.29	5.3	Bajhang

Source: National Earthquake Monitoring and Research Centre 2024

The impact of an earthquake can be influenced by various factors, including its magnitude, depth, local geology, and distance from populated areas. Additionally, it is now increasingly acknowledged that construction practices and the effectiveness of the preparedness and response mechanisms are even more determining factors for earthquake-induced damages and losses (Subedi, 2020). The following table 2 shown the damage infrastructure of Bajhang district which would lasting consequences of people.

Table 2

Damage to Infrastructure due to the October 2023 Earthquake

SN	Local Government	Human Lose		Private Houses		Government Buildings (Schools, Health Post, Palika Offices etc.)	
		Died	Injured	CD	PD	CD	PD
1)	Bitthadchir RM		2	6	0	0	9
2)	Bungal Municipality		2	73	489	9	18
3)	Chhabispathivera RM		4	396	789	6	17
4)	Durgathali RM			184	384	0	0
5)	Jayaprithivi Municipality	1	6	482	853	29	28
6)	Kedarsyun RM		1	206	848	23	0
7)	Khaptadchhanna RM		1	449	836	13	2
8)	Masta RM		4	410	924	17	34
9)	Saipal RM			0	18	0	12
10)	Surma RM			0	233	0	5
11)	Talkot RM		1	25	358	9	12
12)	Thalara RM			664	408	17	15
Total		**1**	**21**	**2895**	**6140**	**123**	**152**

Note: RM (Rural Municipality), CD (completely damage), PD (partially damage), Respective Municipalities LDMC and DDMC Meeting minutes, (2024)

Tragically, one person lost their life and 21 persons were badly injured due to the earthquake that hit in 2023 Bajhang district (Appendix- 2). The loss of life indicates the severity of the event and the potential dangers associated with it. The earthquake caused extensive damage to residential buildings in Jay Prithvi Municipality. A total of 482 houses were reported as completely damaged, while 853 houses suffered partial damage. The earthquake also resulted in damage to government offices in the

municipality. Twenty-eight government office buildings were reported as completely damaged, while 29 government office buildings suffered partial damage.

Fortunately, there were no human casualties in Thalara Municipality due to the earthquake. This is a positive outcome, indicating that the community was relatively resilient and able to evacuate or find safety during the event. The earthquake caused substantial damage to residential buildings in Thalara. A total of 664 individual buildings were reported as completely damaged, while 408 houses were damaged partially. The government buildings in Thalara were also affected by the earthquake. Seventeen government buildings were reported as completely damaged, while 15 government houses suffered partial damage. The earthquake caused extensive damage to residential buildings in Chabispathivara rural municipality. A total of 396 houses were reported as completely damaged, while 789 houses suffered partial damage. The earthquake also resulted in damage to government offices in the municipality. Six government office buildings were reported as completely damaged, while seventeen government office buildings suffered partial damage.

The landslide incident in jayprithivi Municipality that resulted in the tragic loss of a (Gomati Dhami fourty years old Jayaprithivi Municipality-11) woman’s life and injuries to two children from Satyabadi School namely Pramila joshi and Salina joshi The earthquake triggered multiple landslides in the district, with 20 places being affected by landslides (Sharma, 2023). Landslides can occur when the ground becomes unstable due to seismic activity, and in this case, it causes a dangerous situation for the people in the affected areas.

1.2 Definition and Conceptualization

A disaster is defined as "a severe disruption of the functioning of a community or a society involving widespread human, material, economic, or environmental losses and impacts, that exceed the ability of the affected community or society to cope using its resource" by the United Nations International Strategy for Disaster Reduction (UNSDRR, 2015). The effects of disasters such as earthquakes include death, injury, disease, and other negative effects on people's physical, mental, and social well-being in addition to property damage, asset destruction, loss of services, disruption of the

social and economic system, and environmental degradation. The impending calamity could affect numerous aspects of life, including health, livelihoods, possessions, and services. It could also affect a specific group or society at some point in the future. Hazards of disasters (Basher, 2009)

Disaster has been defined as a sudden accident or a natural catastrophe that causes great damage or loss of life (Ritter, 2014, p. 214). The International Federation of Red Cross Society (IFRC) defines a disaster as a sudden, calamitous event that seriously disrupts the functioning of a community or society and causes human, material, and economic or environmental losses that exceed the community's or society's ability to cope using its resources (IFRC, 2016). Though often caused by nature, disasters can have human origins. The combination of hazards, vulnerability, and inability to reduce the potential negative consequences of risk results in disaster (Cipullo et, at, 2016). That can be presented as.

$$\textbf{Disaster} = \frac{\text{Vulnerability} + \text{Hazard}}{\text{Capacity}}$$

Earthquake: Seismic waves are produced when there is a sudden release of energy in the Earth's crust, and this is known as an earthquake. Tectonic plates, which are broad segments of the Earth's crust floating atop the semi-fluid asthenosphere underneath them, are usually to blame for it. The intensity of earthquakes varies, from little, hardly perceptible tremors to powerful, potentially fatal events that can result in significant damage and casualties (Cassidy, 2013).

Vulnerability: Vulnerability can be defined as factors that determine the degree to which someone's life, livelihood, property, and assets are put at risk due to natural hazards and their capacity to anticipate, cope with, resist, and recover from the impact of the disasters (Singh et al., 2014)

Disaster Risk Reduction: The idea and practice of disaster risk reduction, also referred to as just disaster reduction, is to lower the likelihood of disasters by methodically analyzing and managing their causes, which include lowered exposure to hazards, lowered property and human vulnerability, prudent land and environmental management, and increased readiness for unfavorable outcomes. In addition to a range

of institutional and operational capacities, vulnerability and risk assessment are often the main foci of disaster reduction strategies (Naheed, 2021). In order to reduce the danger of disaster, it is necessary to evaluate the vulnerability of significant buildings as well as the social and economic infrastructure, use efficient early warning systems, and employ a wide variety of specialized scientific, technological, and other skills.

The goal of disaster risk reduction is to minimize the loss of lives, livelihoods, and assets, as well as to enhance the capacity of individuals, communities, and institutions to cope with and recover from disasters. This includes measures such as improving early warning systems, enhancing infrastructure resilience, promoting community participation and awareness, strengthening governance and institutional frameworks, and fostering sustainable development practices (Madu & Kuei, 2018).

In the context of Nepal, where the institutional framework is written in the Disaster Risk Reduction and Management Act of 2017 a National Council for Disaster Risk Reduction and Management (NCDRRM) chaired by the Prime Minister is an apex body to oversee disaster risk reduction and management (*DRRMA*, 2024). To carry out the council's policies and goals, there is an executive committee led by the Home Minister, as well as an expert team of no more than five members from several theme areas such as geology, environment, infrastructure, and others. The National Disaster Reduction and Management Authority (NDRMA) is established under the Home Ministry (Nepal et al., 2018). At the provincial level, the chief minister chairs the Province Disaster Management Committee (PDMC). At the district level, there are District Disaster Management Committees (DDMC) and Local Disaster Management.

Disaster Risk Management: Disaster risk management is the systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies, and improved coping capacities to lessen the adverse impacts of hazards and their possibility of disaster. Disaster risk management aims to avoid, lessen, or transfer the adverse effects of hazards through activities and measures for prevention, mitigation, and preparedness (UNISDR, 2009).

1.3. Bajhang District

Bajhang district, located in the Far Western Province of Nepal, is characterized by its geographical coordinates of Latitude 29° 32' 59.99" N and Longitude 81° 11' 60.00" E (G.C. et al., 2019). It shares borders with Baitadi and Darchula districts to the east, Achham district to the south, and Humla district to the west. It is administered from its headquarters in Chainpur. The distance between Kathmandu and Bajhang is approximately 882.8 kilometers road. The population of Bajhang is estimated to be 189085, with moderate growth, and encompasses diverse ethnic groups such as Brahmin, Chhetri, Thakuri, Dalit, Magar, Gurung, and others. The primary languages spoken are Nepali and Bajhangi, alongside local dialects (CBS, 2022). Bajhang experiences diverse climate zones, ranging from subtropical to alpine, with variations in temperature and precipitation. The district is susceptible to natural hazards such as earthquakes, landslides. Environmental concerns encompass deforestation, soil erosion, and depletion of natural resources (Paudel et al., 2021).

1.4. Statement of Problem

A statement of the problem is used in research work as a claim that outlines the problem addressed by a study (Kevin, 2023). The statement of the problem briefly addresses the question: What is the problem that the research will address?

Disaster induces human casualties, infrastructure damage, and other impacts on society which are usually phenomena in the universe due to the disaster. Nepal lies in one of the most fragile eco-regions of the world and is prone to natural disasters. The country is highly prone to natural hazards such as floods, landslides, and fires, extreme weather events, including thunderstorms, epidemics, cold waves, GLOF, and earthquakes. In the context of earthquakes Nepal lies in the 11^{th} position in the world due to the high hazard, high vulnerability, low capacity, and high exposure (Lamsal et al., 2017).

On 3 October 2023, an earthquake of magnitude Mw 5.3 followed by another Mw 6.3 struck the Bajhang district of Nepal killing 1 person and injuring 25 others. Approximately 65,000 people (14,430 households) have been displaced across seven districts of far western province of Nepal. The earthquake not only affected Bajhang

district, but it severely affected other neighboring districts and the tremors were felt as far as Delhi in India (IFRC, 2023).

The research aims to investigate the disaster risk reduction initiatives implemented in Bajhang before the 2023 earthquake, analyze the causes of earthquake damage in the Bajhang Earthquake 2023, and assess the effectiveness of disaster risk reduction and management response during the 2023 Bajhang Earthquake. This study seeks to provide insights into the preparedness measures, vulnerabilities, and response strategies in Bajhang, shedding light on areas for improvement in disaster risk reduction and management practices to enhance community resilience and minimize the impact of future disasters.

1.5. Research Questions

The earthquake had a huge dispersion that affected the community. The research investigated what initiatives were taken before the earthquake, the causes of the earthquake, and the response after the earthquake. The research questions were:

1.5.1. What were the key disaster risk reduction initiatives implemented in Bajhang before the earthquake in 2023?

1.5.2. What were the causes of earthquake damage in the 2023 Bajhang earthquake?

1.5.3. How effective was the DRRM response during the Bajhang earthquake?

1.6. Objectives of the Study

The objective of a study serves as a guiding principle that outlines the purpose and goals of the research. The objectives of a study typically aim to address specific research questions.

1.6.1. General Objectives

The general objective of the study was to understand the initiatives taken before the earthquake, the causes of the earthquake, and the response after the earthquake.

1.6.2. Specific Objectives

The specific objectives of this study of DRRM initiatives and responses to the 2023 Bajhang Earthquake were the following:

i. To assess the disaster risk reduction initiatives implemented in Bajhang before the earthquake in 2023.
ii. To analyze the causes of earthquake damage in the Bajhang Earthquake 2023
iii. To assess the effectiveness of DRR and response during the 2023 Bajhang earthquake.

1.7. Significance of the Study

The study provided an opportunity to analyze the effectiveness of specific initiatives and responses implemented during and after the Bajhang Earthquake. Identifying strengths and weaknesses can offer valuable insights and lessons learned that can inform future disaster risk reduction and management efforts in earthquake-prone regions?

Understanding the effectiveness of initiatives and responses in Bajhang contributed to enhancing disaster preparedness in similar contexts. The findings can guide policymakers and practitioners in identifying gaps and implementing targeted measures to improve community resilience and response capabilities. The study informed evidence-based policy and decision-making processes related to disaster risk reduction and management. It can provide insights into the impact of existing policies, identify areas for improvement, and support the formulation of new strategies to enhance disaster resilience. By examining initiatives and responses in Bajhang, the study shed light on the role of community engagement, awareness, and education in disaster risk reduction. It can highlight the importance of empowering communities to actively participate in preparedness and response activities, fostering a sense of ownership and resilience.

The findings of the study contributed to the existing knowledge base on disaster risk reduction and management, particularly in earthquake-prone regions. They can be

shared with relevant stakeholders, researchers, and practitioners, fostering collaboration, and facilitating the exchange of best practices.

1.8. Limitation of the Study

The study is limited to only one district that has been affected by an earthquake which includes Jay Prithivi municipality and adjacent rural municipality. The study is a micro-level study and aims to limit the severely affected numbers of the population of other affected districts from earthquakes such as Bajura, Acham, and other districts. The study's dependency on a small sample size may have an impact on its generalization and the capacity to make thorough conclusions that apply to a wider range of situations. The study might overlook important information by focusing just on the Bajhang Earthquake of 2023. This could allow for the comparison of several earthquake incidents, which could provide information for more comprehensive disaster risk reduction plans.

CHAPTER II

LITERATURE REVIEW

A literature review is a written summary of relevant sources that describe the current state of knowledge on a specific topic. It serves to define the field of study, identify key information, and provide a synthesis of existing knowledge (Creswell & Creswell, 2018). In other words, literature review is the critical recap of what has been already researched on the topic. The following are the reviews of the book and journal related to disaster; those books stated what a disaster is? What types of initiatives, and responses by the stakeholders before, during, and after the disaster? This literature review categories into the international, national, and regional levels of earthquake disasters.

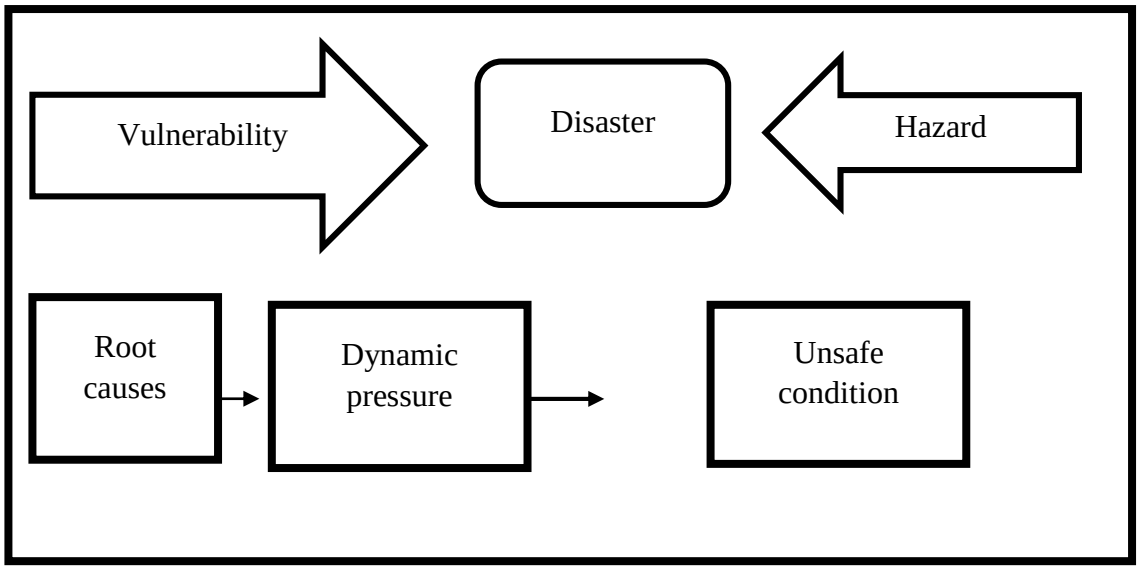
2.1 Theoretical Review

2.1.1 Pressure and Release Model Theory

The Pressure and Release (PAR) Model, developed by Wisner et al (2004), is a framework for understanding disaster vulnerability and risk. It argues that disasters occur at the intersection of two opposing forces: natural hazards and the processes that generate vulnerability. The model has three components on the social side: root causes, dynamic pressures, and unsafe conditions (Awal, 2015). Root causes include economic, political, and demographic processes that affect resource distribution. Dynamic pressures are local circumstances that add to the vulnerability. Unsafe conditions are specific ways in which vulnerability is expressed in time and space, such as dangerous livelihoods, weak infrastructure, and disaster-prone locations. On the natural side, the model considers the natural hazards themselves. When physical exposure to hazards and socio-economic pressures intersect, a disaster occurs (Dintwa et al., 2019). The Pressure and Release (PAR) model is a framework used to understand the underlying causes of vulnerability to natural disasters like earthquakes. It suggests that disasters occur when a hazard impacts a vulnerable population, and that vulnerability is determined by a progression of factors. The following figure showed of pressure and release model in earthquake.

Figure 1

Pressure and Release Model



Note: Pressure and Release (PAR) Model (Wisner et al., 2004)

The Root causes are the fundamental social, political, and economic structures that generate vulnerability, such as poverty, inequality, and lack of political rights. One the other hand the Dynamic pressures are processes and activities that translate the effects of root causes into unsafe conditions, such as rapid urbanization, environmental degradation, and lack of disaster preparedness (Wisner et al, 2004).

Furthermore, hazardous conditions are the precise ways in which a population's susceptibility manifests itself in time and space in connection with a hazard, such as living in dangerous areas, having a fragile local economy, and lacking resilient infrastructure.

2.1.2. Disaster Management Cycle

The disaster management cycle, also known as the disaster management continuum, is a concept that describes the steps needed in efficiently managing disasters. The cycle is usually divided into four stages: prevention, preparation, response, and recovery (Khan et al., 2008). The following figure-2 shown the all stages of disaster.

Figure 2

Disaster Management Cycle

Note: The Disaster Management Cycle. Flanagan et al. (2011).

a. Mitigation

Mitigation is to lessen the loss of human life and property caused by a disaster. Both structural and nonstructural solutions may be used (Kang et al., 2009). Structural approaches entail adjusting the physical properties of a building or environment to lessen the impacts of a disaster, while nonstructural procedures involve adopting or amending building codes to optimize safety

b. Preparedness

Individuals, communities, industries, and organizations plan and train for what will happen in the event of a catastrophe. This stage comprises developing strategies, plans, and processes for dealing with future crises (Sutton and Tierney, 2006). Emergency plans, training, and exercises may be used to ensure that people, equipment, and systems are prepared to respond to a disaster.

c. Response

The response stage involves the immediate response to a disaster. Response measures include search and rescue operations, providing emergency medical assistance, and

setting up emergency shelters. Response teams work to stabilize the situation and reduce the potential for further harm (Jedlovec, 2009).

d. Recovery

The rehabilitation stage aims to return the affected community to normalcy. The recovery operations include infrastructure reconstruction, the provision of medical and social services, and financial aid to individuals and families (Jedlovec, 2009). A rehabilitation plan could include ongoing medical treatment, such as physical therapy, for people who were injured during a disaster, or a support group for individuals who had any emotional trauma.

2.2 Empirical Review

An empirical review in a literature review involves evaluating previous empirical studies to address specific research issues and uncover gaps, convergence, and conflicts in the field. It aims to provide a comprehensive analysis of the current state of knowledge, theories, historical context, and significant findings in a particular subject area.

2.2.1 Major earthquakes Recorded in the World

The major earthquake that has occurred in the world since 1960 is to learn how earthquakes, as a natural phenomenon, occur frequently in certain parts of the world and the potential impacts on human populations (Oluwafemi et al., 2018). Examining the earthquake, it has resulted in substantial societal costs, killing hundreds of thousands of people, injuring, and missing individuals, and destroying private and public property. Simultaneously, it appears that loss of life and property has a social dimension, as does the level of readiness and awareness, all of which are crucial in mitigating hazardous circumstances (Oluwafemi et al., 2018). Major earthquakes occurring since 1960 are summarized in this section to learn thatearthquakes as a natural phenomenon occur frequently in parts of the earth and their potential effects on humans. So far, the earth has quoted the largest earthquake in the last 100 years. On May 22, 1960, a magnitude 9.5 earthquake shookthe region from southern Chile (Pallardy, 2024).

On July 28, 1976, in the Chinese city of Tangshan, an earthquake killed at least 250,000 people. Investigating the earthquake has resulted in huge social costs, killed hundreds of thousands of people, injured and lost people, and destroyed private and public property. At the same time, it seems that loss of life and property has a social status, a degree of readiness, and awareness and it is important to reduce risk (Huixian et al., 2002).

2.2.2. Historical Background of the Earthquake in Nepal

According to studies, Nepal is during the Himalayan chain, which is prone to earthquakes. The Himalayas are the result of a collision between the Indian subcontinent and the Eurasia/Tibet Plate. According to the Global Positioning System (GPS), the Indian subcontinent is 20 mm below the Tibetan Plate per year (Thapa et al., 2023). This reduction process produces a junction, which is absorbed by the junction across the plate, resulting in numerous earthquakes.

Nepal has a lengthy history of devastating earthquakes. As a result, research showed that Nepal is the world's eleventh most earthquake-prone country due to its location in a high seismic area (Bothara et al., 2018). According to SAARC (2009), high-intensity earthquakes occur once every 75 years, but lower-intensity earthquakes occur more frequently during the wet season. Nepal has a history of catastrophic earthquakes. In the last 80 years, four significant earthquakes (magnitude 7.9) have occurred, followed by a major aftershock of 7.3 on May 12, 2015. The 5.2 magnitudes earthquake then followed the second hit of 6.3 magnitudes in Bajhnag earthquake 2023 on, October 3 and On November 3, 2023, at 23:48 hours, an earthquake of Mw 6.4 hit multiple areas within the Jajarkot and Pashchim Rukum districts of the Karnali province, situated in the western region of Nepal which caused the most physical damage. After, since the 13th century, historical archives have recorded at least ten big earthquakes (Reid, 2023).which are shown in table 3.

Major General Brahm Shamsher Jung Bahadur Rana's book, Nepal's Great Earthquake (1934) published in March 1991, contains a long account of 90 years of earthquakes: History reveals a great earthquake in Nepal and its impact on the border areas of neighboring countries such as India, Tibet, and China. The data show that Kathmandu

is one of the most frequent earthquakes since its history began in June 1255 (Rāṇā & Lall, 2013).

Table 3

Major Earthquakes recorded that hit Nepal from 1205-2024 A.D.

Date	Place	Latitude	Longitude		Magnitude
2023, 3 November	Jajarkot				6.3
2023, 3 October	Bajhang	29.58	81.10		5.3/6.3
2015, 25 April	Kathmandu/India/Tibet	28.15° N	84.71 °E	8,922	7.8
2015, 12 May	Nepal/China/India/Bangladesh	27.97° N	85.96 °E	213	7.3
2011, 18 Sept	Sikkim, India	27.33° N	88.62 °E	111	6.9
1997	Far western	-° N	-	-	-
1994	Western region	-° N	-	-	-
1993	Mid-western	-	-	-	-
1988, 20 Aug	Kathmandu/Bihar	26.78° N	86.62 °E	1,091	6.6
1980, 29 July	Nepal/India	29.6 ° N	81.09 °E	200	6.5
1966, 27 June	Nepal/India	29.55 ° N	80.85 °E	80	6.3
1934, 15 Jan	Nepal//Tibet	26.77 ° N	86.76 °E	8,519	8.0
1916, 28 Aug	Nepal/Tibet	30 ° N	81° E	3,500	7.7
1869, 7 July 1834 Jun	Kathmandu Kathmandu	27.7 ° N	85.3 ° E	750	6.5
1833, 26 Aug	Kathmandu/Bihar	27.9 ° N	85.5 ° E	6,500	8.0
1767 July	Northern Bagmati zone	28 ° N	85.5 ° E	4,000	7.9
1681 Jan	Northern Kosi zone	27.6 ° N	87.1 ° E	4,500	8
1505, 6 June	Near Saldang, Karnali zone	29.5 ° N	83 ° E	6,000	8.8
1408 August	Near Nepal-Tibet Border, Bagmati	27.9 ° N	86° E	2,500	8.2
1344	Mechi	27.5 ° N	87.5° E	100	7.9
1260	Sagarmatha	27.1 ° N	86.8° E	100	7.1
1255, 7 June	Kathmandu	27.7 ° N	85.3° E	2,200	7.8

Source:- National Geophysical Data Center and Disaster Preparedness Network Nepal (2024) and Major General Brahm Shamsher Jung Bahadur Rana's book, Nepal's Great

Earthquake (1934) published in March 1991, contains a long account of 90 years of earthquakes.

According to the Disaster Risk Reduction and Management Act 2074 "Disaster" means a natural or non-natural disaster causing a threatening situation in any place that results in loss of lives and properties and makes severe impacts on livelihood and the environment. This Act defines an earthquake as a natural disaster.

Bista (1991) stated that the Sudurpaschim Province has a rich history and culture, with many indigenous communities and ethnic groups. Researchers could explore the history and traditions of these communities, as well as their social organization, customs, and belief systems.

Shamsher (1992) recounted his harrowing experience of the devastating 1934 Nepal earthquake, which destroyed practically everything in just three minutes. The earthquake claimed 8,519 lives, with more women than men killed. To save lives and mitigate future earthquake impacts, Shamsher published his book to share his story and educate readers on preventative measures he learned through experience. He emphasizes the importance of preparedness, as earthquakes are unpredictable but their consequences can be minimized through proper planning.

Hoffman and Smith (1999) examined the notion of disasters from an anthropological perspective as well as technical and natural catastrophes, incorporating cultures and communities from several continents. According to editors, a catastrophe is viewed as a process that results in an occurrence that combines a destructive agent from the natural or technical world. Major social and organizational components of a community are impacted by the evolution of processes and events by interrupting or obliterating collective functioning.

Frane and Stephenson (2002) explain that disasters and development have a tight relationship that may both thwart and spur development efforts. Similar to this, the Marxist theory of catastrophe shows how development and disaster management simultaneously attempt to decrease and increase susceptibility to disasters. Poor, minorities, and other marginalized groups often reside in unsafe places and are less able to handle and recover from disasters due to economic realities and political weakness.

UNDP (2004) noted that disaster risk governance includes economic, political, and administrative governance considerations. These relate to poverty, equity, and growth, the means for laying out policy decisions and legal frameworks, and the organizational basis for the implementation of disaster risk management. It further elaborates on the exercise of economic, political, and administrative authority to manage a country's affairs at all levels. It comprises the mechanisms, processes, and institutions through which citizens and groups articulate their interests, exercise their legal rights, meet their obligations, and mediate their differences. It brings together the actions of state, non-state, and private sector actors.

Ritchie (2004) examined the ideas of safety, assurance, and security in the travel and tourism sector as well as the possible effects of risk, vulnerability, crisis, tragedy, hazard, emergency, and political unrest. The study intends to highlight the effects of disasters on tourism in addition to focusing on crisis management, disaster management, and creative marketing strategies for reviving tourism—all of which are, in the context of Nepal, very rarely discussed issues.

Goula et al. (2006) explained that an essential part of reducing earthquake risk is urban design. Expanding paved roads and areas, poorly designed cities, and population growth all contribute to urban development and raise the danger of disaster. Rapid urbanization will raise the danger of disasters, but it will also present new chances for resilience-building.

Allen (2006) provides an overview of community-based disaster preparedness (CBDP) and climate adaptation in developing countries, highlighting the importance of engaging communities in disaster risk reduction and preparedness efforts.

Shaluf (2007) divided disasters into three categories: natural, man-made, and hybrid catastrophes. He believes that each of the three groups encompasses all types of disasters. Although the characteristics and impacts of disasters vary, they all have one thing in common: intensity. Natural disasters are those that are brought on by natural forces. Human-induced disasters are those that occur because of human decisions. Hybrid disasters are defined as disasters that result from both natural and human-

induced sources. Subsequent disasters are those that occur after natural or man-made calamities.

The Government of Nepal, worked with NRRC, the Flagship Four Programs focused on Community-Based Disaster Risk Reduction (CBDRR). It initiated this work to define disaster resilience by developing the nine minimum characteristics reflecting a disaster resilient community including the organizational base at the ward and community level, Reduction management plan at the municipality level, and Local-level risk/vulnerability reduction measures along with others (NRRC, 2009).

Paton et al. (2010) discuss the issue of earthquake preparedness and mitigation, emphasizing the fact that earthquakes cannot be predicted but their impacts can be reduced through effective planning and preparation. The text also suggests that improper development activities are contributing to the increasing risk of earthquakes and that basic knowledge and skills are necessary for individuals to prepare themselves for earthquake events.

Sharma et al. (2013) explain the Sudurpaschim Province's terrain consists of Tarai, Hills, Middle Mountains, and High Mountains, with the highest point being located at 7,132 meters. Most settlements are inaccessible and far away. All district offices are nevertheless connected to the national road system five via paved roads and four via earthen paths. Natural calamities including earthquake, floods, landslides, and forest fires are common in the area.

Kollek (2013) focuses on disaster preparedness in the context of healthcare systems, highlighting the importance of planning, training, and collaboration among healthcare providers and stakeholders.

The Government of Nepal (GoN) approved the National Disaster Response Framework (NDRF) in 2013, and it serves as a crucial set of guidelines for disaster response. The many stakeholders' roles during a disaster are defined under this framework. The NDRF serves as a thorough manual for a coordinated and successful national response that is only restricted to preparation and execution (Ministry of Home Affairs, 2013).

As a national focal point for disaster management in Nepal, MoHA has been taking the initiative to address the problems of disasters and reduce their impacts. To lessen the effects of disasters, MoHA is very active in educating the public, providing training, and collaborating with local, national, and international organizations (United Nations Disaster Risk Reduction, 2013).

Wachter & Uslander (2014) examine the role of information and communication technology (ICT) in disaster preparedness and management. It discussed the potential of ICT to enhance early warning systems, situational awareness, and communication during disasters.

Litcofsky (2015) Nepal has implemented various earthquake preparedness initiatives, including the Kathmandu Valley Earthquake Risk Management Project and the School Earthquake Safety Program, to simulate emergencies, provide funding for safety drills, and promote awareness. Partnerships with international agencies have led to sustainable rebuilding efforts, like retrofitting hospitals and training locals to construct earthquake-resistant buildings. Open spaces are being safeguarded for emergency response, and technological advancements aid in population tracking for efficient rescue operations during disasters.

Karisson (2015) emphasizes the criticality of planning and preparation for disasters, citing the 2015 Nepal earthquake as a prime example. Effective and timely disaster relief efforts are crucial, with the lack of information on affected people's locations posing a significant challenge to post-disaster relief operations.

Chaulagain et al. (2015) The study assessed seismic risk and economic losses in Nepal using an updated model, revealing high earthquake risk and potential economic losses, emphasizing the need for preparedness and policy adjustments.

Devkota et al. (2015) Landslide susceptibility mapping is crucial for disaster management and development planning in Nepal. The Mugling-Narayanghat road area was evaluated using GIS and statistical models, achieving fair accuracy for hazard mapping at all government levels.

Adhikari et al. (2016) study Community Preparedness for Earthquake Risk in Rural Nepal" which investigates the preparedness of rural communities in Nepal for earthquake risks, and the effectiveness of disaster risk reduction programs in these communities.

Kunwar, & Chand (2016) highlighted the importance of the heritage industry and its vulnerability in the event of a natural disaster like the earthquake in 2016. To compare what has been done to what still needs to be done to achieve the ultimate aim of tourist recovery; the article first assesses the impacts of the earthquake on tourism in Bhaktapur before examining the process of tourism recovery and the issues with heritage reconstruction.

The International Risk Governance Council (IRGC), a fundamental reference point for risk governance concerns, has indicated that disaster risk governance includes risk assessment, risk management, and risk communication. These three elements require an understanding of formal and informal institutions, the social and economic context in which risk is evaluated, and the involvement of stakeholders in political and policy arenas that range from the local to the global levels (IRGC, 2017).

Gianisa & Le De (2018) explored the perceptions of local communities on the impact of the 2015 earthquake in the region and found that they perceived it to be a punishment from God. The study highlights the need for cultural sensitivity in disaster risk reduction strategies.

Tkachuck et al. (2018) examined disaster readiness among students to assess the effectiveness of disaster preparedness initiatives. The study evaluated students' preparedness levels and confidence in their universities' disaster preparations, focusing on the relationship between perceived danger and preparedness. The research highlights the importance of academic institutions prioritizing disaster preparedness efforts.

Liu et al. (2018) conduct a policy analysis of disaster risk reduction and management in the region and identify the gaps and challenges in the implementation of disaster risk reduction policies. The literature suggests that effective disaster management and risk reduction strategies require a coordinated effort between government agencies, non-governmental organizations, and local communities

Chamlagain (2018) sated that the Himalayan belt is seismically active due to tectonic movement, posing a high earthquake risk to millions. Nepal's earthquake risk reduction efforts, including research, building codes, and awareness programs, aim to mitigate this threat.

Community-based approaches, such as those identified in the case study by Shrestha et al. (2019), are effective in promoting disaster resilience at the local level. However, there are also challenges related to funding, capacity building, and institutional coordination that need to be addressed to improve disaster management in the Sudurpaschim Province of Nepal.

Pandey (2019) Nepal faces increasing vulnerability to disasters, impacting infrastructure, livelihoods, and lives. The study suggests institutional changes for effective disaster risk management, utilizing secondary data and emphasizing the need for enhanced efforts at all government levels.

Ghazoui et al. (2019) the study investigated earthquake occurrences in western Nepal, revealing that the last earthquake on the Main Frontal Thrust happened in 1505 AD. Analysis of lake sediment records indicated eight earthquake-triggered turbidities in the last 800 years, suggesting higher seismic activity than previously known. The research further proposed that western Nepal could be as seismically active as central Nepal, emphasizing the need for further data to reassess seismic risk in the central Himalayas.

Azad et al. (2019) examine various aspects of disaster preparedness, including risk assessment, emergency planning, communication, and education. It also discusses the importance of collaboration and partnerships among stakeholders in disaster management.

Several studies have been conducted on the topic of disaster management and risk reduction in the Sudurpaschim Province of Nepal. Dhyani et al. (2020), provide an overview of the disaster risk reduction activities in the region and identify the challenges and opportunities for effective disaster risk reduction.

Ruszczyk et al. (2020) studies about empowering women through participatory action research in community-based disaster risk reduction efforts provide a systematic review

of the literature on community-based disaster risk reduction in Nepal and identify gaps in knowledge and research related to the Sudurpaschim Province Nepal.

Khanal (2020) Nepal ranks 11th globally for earthquake risk and 4th for climate risk, with over 80% of its population exposed to natural hazards like floods, landslides, earthquakes, and GLOFs. Kathmandu is among the most vulnerable cities worldwide in terms of earthquake impact

The Nepal Hazard Management Reference Handbook, published in October 2020, goes into detail regarding the country's hazard profile and presents disaster management policy. Our disaster governance is governed by the Disaster Risk Reduction and Management (DRRM) Act of 2017 and the Local Government Operation Act of 2017 (CFE-DM, 2021).When the National Disaster Risk Reduction Management Authority (NDRRMA) was created under the Ministry of Home Affairs (MoHA), the DRRM Act 2017 was changed to the DRRM Act 2019 in March 2019 . The nation's DRRM-related operations are managed by NDRRM. The National Council, the Executive Committee, and the NDRRMA are only a few of the structural structures that the DRRM has under MoHA. Through MoHA, the National Emergency Operation Centre (NEOC) manages the coordination of foreign and domestic organizations' response operations. After obtaining information from the location where an emergency is expected to arise for disaster relief and emergency, the DRRM executive committee and the National Disaster Risk Reduction and Management Authority (NDRRMA) respond (Center for Excellence in Disaster Risk Management and Humanitarian Assistance, 2020).

Khanal (2020) asserted that the DRM statute of 2017 and the consequent transition in Nepal's 2015 Constitution from central to local government handed the 753 newly created municipalities complete authority for disaster risk management policy and planning. The researcher further stated that the ability to make more decisions was welcomed by communities and local governments, but many of them felt overburdened by their complicated portfolios, which included how to guarantee a functional governance system.

Thapa et al. (2022) reviewed the disaster risk reduction activities in the region and identified the challenges and opportunities for effective disaster risk reduction. They

assess the disaster risk reduction practices in the Sudurpaschim Province of Nepal and identify the challenges and opportunities for effective disaster risk reduction.

To analyze the above literature researchers have investigated the relationship between catastrophes and development, concluding that disasters can both impede and stimulate development efforts, with underprivileged populations more vulnerable due to economic and political considerations. Disaster risk governance takes into account economic, political, and administrative concerns such as poverty, equity, growth, policy decisions, legal frameworks, and organizational disaster risk management implementation. Nepal is moving toward full federalized disaster governance, in line with the constitution and incorporating the Sendai Framework for Disaster Risk Reduction into national strategy. Disaster governance entails coordination between federal, provincial, and municipal government organizations, as well as the implementation of disaster management and response institutions and systems. Research and education play critical roles in catastrophe risk reduction, with a need for localized resilience theories, effective interventions for vulnerable areas, and efficient management of academic findings. Several efforts target earthquake preparedness, seismic risk assessment, landslide susceptibility mapping, community preparedness, and disaster readiness among students. The region faces problems such as funding restrictions, institutional coordination issues, and deficiencies in disaster management knowledge, which must be addressed for increased catastrophe resilience and risk reduction. Based on the above there was no any literature found in the 2023 Bajhang earthquake.

2.3. Research Gaps

A research gap is an area or issue that has not been thoroughly explored or handled in the existing literature, creating an opportunity for additional research. It is simply an unanswered question or unresolved problem in a topic that demonstrates a gap in present research (Rautenbach, 2022)

The researcher revived above literature, the researcher could not find any information on disaster risk reduction initiatives, the causes of earthquake damage, and the effectiveness of response in disaster risk reduction in 2023 Bajhang earthquake.

The absence of comprehensive studies on earthquake preparedness in Bajhang the necessity for targeted research to inform future disaster risk reduction strategies. This research not only contribute to enhancing local-level disaster preparedness but also provide valuable insights for developing effective risk reduction measures to mitigate the potential financial and human costs of earthquakes. Therefore, there is a pressing need for more studies and research initiatives to address these crucial gaps and pave the way for more informed disaster preparedness and response efforts in vulnerable region.

CHAPTER III

RESEARCH METHODOLOGY

The qualitative study was used in this research. Snow ball sampling was used to collect primary. This chapter provides a comprehensive overview of the research design, methods employed, nature and sources of data, data processing techniques, analysis procedures, and methods of presentation. Additionally, the conceptual framework also provided. The following points were taken into consideration when developing the research methodology.

3.1. Research Design

The research design refers to the overall plan that researcher choose to integrate the different components of the study in a coherent and rational way, thereby, ensuring researcher effectively address the research problem; it constitutes the blueprint for the collection, measurement and analysis of data in any research work. The nature of this research descriptive and analytical as the information originates from various sources synchronized and analyzed properly (Labaree, 2024). This chapter pertains to the methodology employed in the study. Qualitative methodology was used. The main objective of the research was to conduct an in-depth analysis of 2023 Bajhang earthquake.

The goal of this study's descriptive research is to comprehend and characterize the probable outcomes of the Bajhang earthquake in 2023. It also focuses on offering suggestions for readiness actions to lessen the effects of calamity in the future. In descriptive research, facts and data are typically gathered in order to paint a clear picture of a specific occurrence. Exploratory study, on the other hand, describes the situation and effects of earthquakes. This indicates that its goal is to find fresh perspectives, concepts, or viable approaches to catastrophe risk reduction in the research field. An approach that is more flexible and open-ended is frequently used in exploratory research. In a similar vein, people's perceptions were ascertained through qualitative research methodologies. Methods that enable a thorough examination of human

experiences, such as focus groups discussion, Key informant interview, questionnaires, and interviews, was frequently used in qualitative research.

The primary and secondary data sources were used for the justification of the study that provides a discussion on the research approach, methods and process adopted in the study. Key Informant Interview (KII) and General Interview to gain insights into their personal experiences and opinion about 2023 earthquake in Bajhang.

The snowball sampling approach was a popular method used by researchers to identify potential study participants from hard-to-reach or classify communities. It involves selecting the first volunteers, who then introduce the researcher to more potential subjects, creating a referral chain. This strategy is particularly useful in disaster research. Since it can help reach people who have experienced the disaster and are a part of certain networks or communities, as demonstrated in the case of earthquake disaster management. Snowball sampling can be especially useful when standard sample approaches are impractical or ineffective in post-disaster contexts since it allows researchers to visit remote or underserved regions.

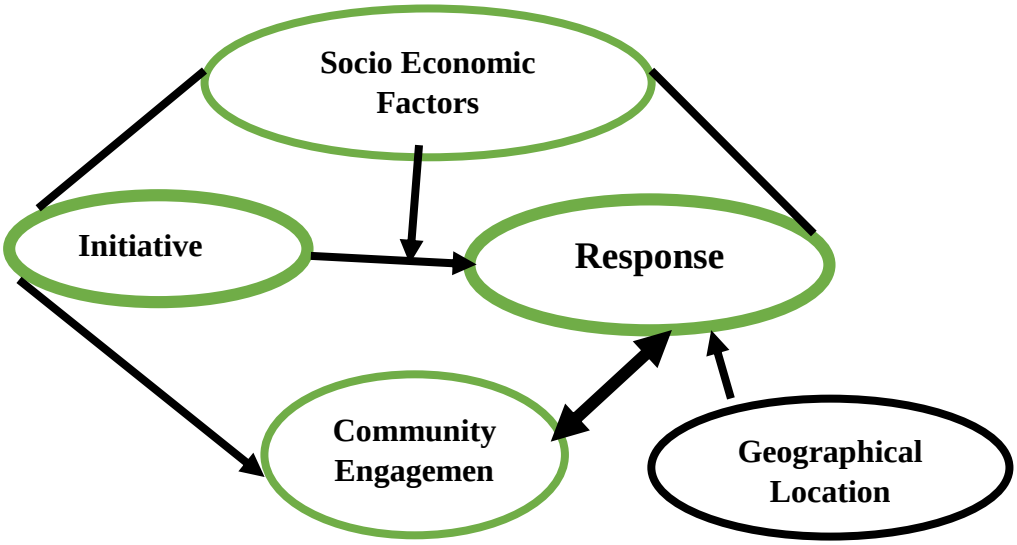
3.2. Conceptual Framework

The conceptual framework is an expression either narratively or graphically of the study being embarked upon. It consists of the study variables: dependent, independent, and at times, intervening or control variables; and the presumed relationships among the variables (Miles et al., 2014). It is equally a depiction of the importance of the study being carried out and the appropriateness/ relevance of the ways/ methods of accomplishing the study (Salawu et al., 2023a). The 2023 Bajhang Earthquake of in Nepal highlighted the need for effective disaster risk reduction and management initiatives. Despite ongoing efforts, the specific initiatives and responses implemented in the aftermath of the earthquake need assessment. Developing a conceptual framework will provide a theoretical foundation to examine the relationships between independent variables (initiatives and preparedness measures) and the dependent variable (effectiveness of disaster risk reduction and management). Additionally, considering moderating variables (socioeconomic factors) and mediating variables (community awareness and education) will enhance our understanding of the

underlying mechanisms and contextual influences. This study aims to contribute valuable insights to guide future disaster risk reduction and management efforts in the earthquake-affected area of Bajhang. The conceptual framework of this research study is as follows.

Figure 3

Conceptual framework of the study



Note: Modified and adopted by researcher (Salawu et al., 2023)

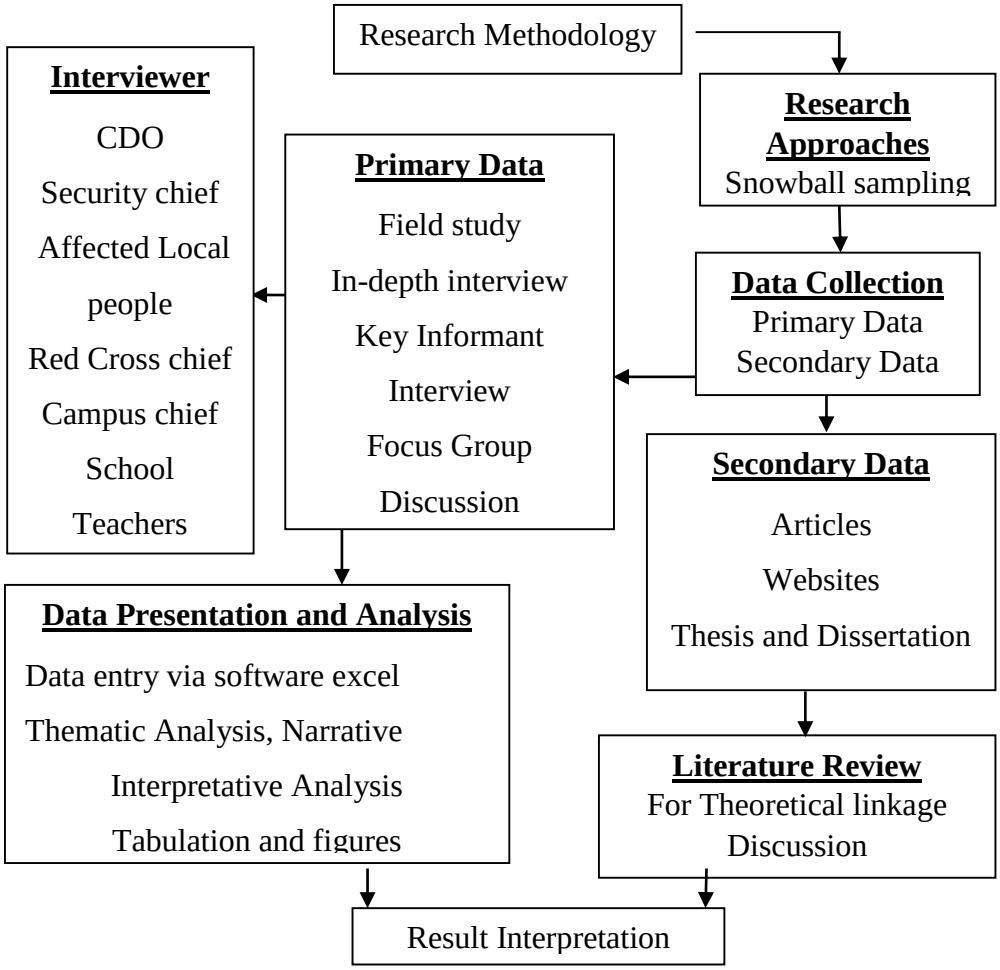
3.3. Nature and Source of Data

The primary sources for data collection on the 2023 Bajhang earthquake include interviews, Key Informant Interviews (KII), and focus group discussions. These methods directly engage with individuals and groups affected by the earthquake, providing valuable firsthand accounts, insights, and perspectives on the event and its aftermath.

Secondary sources, including academic research, reports, publications, and geospatial data, provide additional context, validation, and broader insights into the causes, impacts, and response efforts of the earthquake.

Figure 4

Nature and Sources of Data



Note: Adopted and Modified from Kumari, (2019) and Taherdoost, (2021).

3.3.1. Primary data

The primary data for the study was based on the interview questions designed for respondents of the Bajhang, KII, and FDG. The primary data was collected by formal and informal interviews using a questionnaire. The separate sets of questions for Key Informant Interviews (KII), focus groups, and the questionnaire survey were set to gather diverse perspectives and insights on disaster risk reduction and management in the context of the Bajhang Earthquake.

3.3.2. Secondary data

For this research study, secondary sources of the data were gathered by reaching out to various stakeholders. These included government agencies like the National Disaster Risk Reduction and Management Authority (NDRRMA), the Ministry of Home Affairs (MoHA), the Department of Urban Development and Building Construction (DUDBC), and the Department of Hydrology and Meteorology (DHM).

Additionally, data was collected from the United Nations Mission in Nepal (UNMIN), as well as local community-based organizations (CBOs) and NGOs in Bajhang district. These groups, like the Bajhang District Disaster Management Committee, Bajhang Red Cross Society, Bajhang Women's Cooperative, and Bajhang Youth Club, are closely involved in disaster preparedness efforts and have valuable knowledge about community needs.

Media organizations like Nepal Television, others also sources of data. They are important for spreading information, raising awareness, and reporting on disaster events and responses.

3.4. Tools and Techniques of Data Collection

The primary data collection techniques used in this study were Interviews, KII, and focus group discussions. Interviews, Key Informant Interviews (KII), and focus group discussions are valuable tools for qualitative data collection. Interviews involve one-on-one conversations, KIIs target key stakeholders with specialized knowledge, and focus group discussions facilitate group interactions. These methods provide in-depth insights and perspectives, allowing for a comprehensive understanding of complex issues in disaster research.

3.5. Data Analysis and Presentation

Data analysis is defined as a process of cleaning, transforming, and modeling data to discover useful information for business decision-making. The purpose of Data Analysis was to extract useful information from data and decide based on the data analysis. Data analysis included collection, cleaning, and transforming primary and

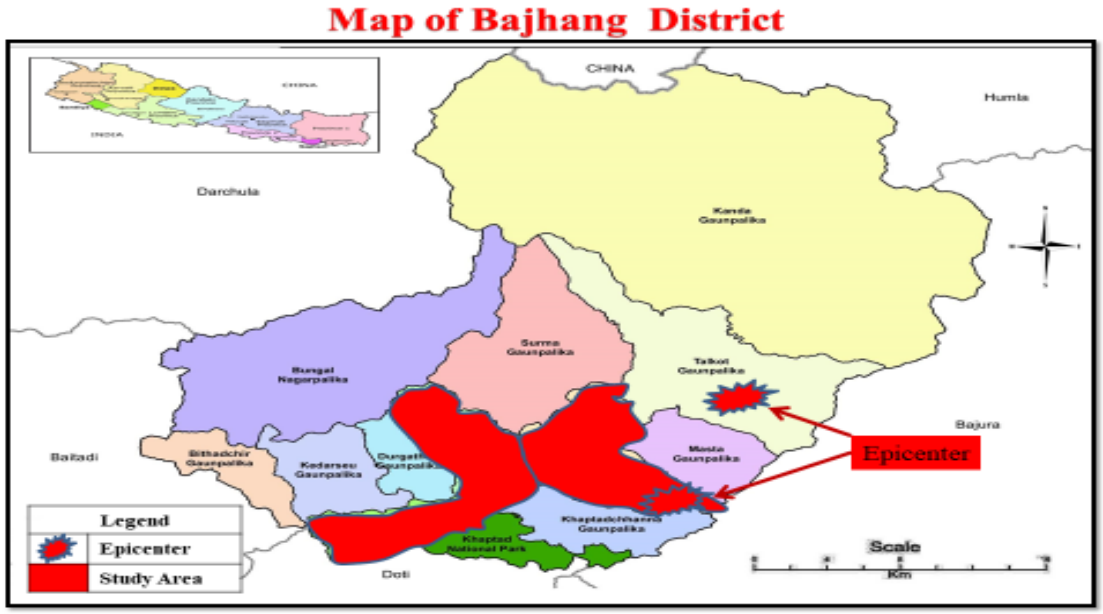
secondary data as necessary. Primary data were interpreted using secondary data to authenticate the findings of primary data. The data and information collected were analyzed in different ways. The results were then presented in a variety of forms including tables, graphs, charts, and pictorials. The statistical analysis of data was analyzed by using statistical tools MS Excel.

3.6. Study Area

Bajhang district is located of Latitude 29° 32' 59.99" N and Longitude 81° 11' 60.00" E (G.C. et al., 2019). It shares borders with the Baitadi and Darchula districts to the east, the Achham district to the south, and the Humla district to the west (fig.2). The research areas of study was Bajhang district, one municipality, and two other rural municipality, namely Jayprithivi Municipality, Thalara rural municipality and chabispathivara rural municipality. The total population of three municipality is 21,933, 15958 and 14474 respectively. The figure 2 shown in the following.

Figure 5

Map of Bajhang District and Location of the study area (Jayapithivi Municipality,Tharala and Chabispathivara village Municipality)



Note: Political Map of Bajhnag district (2022). Modified and Adopted by Researcher (2024)

3.7. Ethical Considerations

An ethical consideration in research refers to the norms and standards for conduct. Norms and values, ethics and discipline, honesty and integrity, carefulness and confidentiality, respect for their rights, openness and honor, legality and value to respondents are considered ethical considerations. During this research, the code of ethics of APA 7th edition was followed strictly. This study promised to protect the confidentiality of the individuals and organizations respectively. The sources and data are kept confidential as per the fundamental ethic of research.

CHAPTER IV

FINDING AND DISCUSSIONS

4.1. Finding

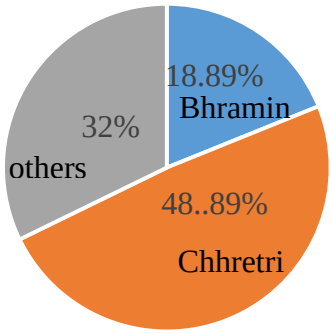
The research on the 2023 Bajhang earthquake aims to comprehensively assess the disaster risk reduction efforts in the region before the seismic event, analyze the causes of the extensive damage, and evaluate the effectiveness of the disaster response and recovery measures. The results of these analysis are supplemented with the information gathered through interviews and focus-group discussions, secondary sources and the results are discussed. In this section, mostly data is presented in multiple forms like pie-chart, table, bar graph, along with its analysis in the context of the study.

4.1.1. Ethnicity of Respondents

A total of 90 households were taken for a survey. Out of the 90 respondents 17 (18.89 %) respondents were Brahmin, 44 (48.89%) were Chhetri and 29 (32.22%) were others as in Figure 5. This distribution indicates a diverse range of participants, which can help in obtaining a more comprehensive understanding of the impact and response to the earthquake across different communities. Such studies need to have representation from all sections of the affected population to ensure that the findings are inclusive and reflect the needs and perspectives of all groups.

Figure 6

Ethnicity of Respondents



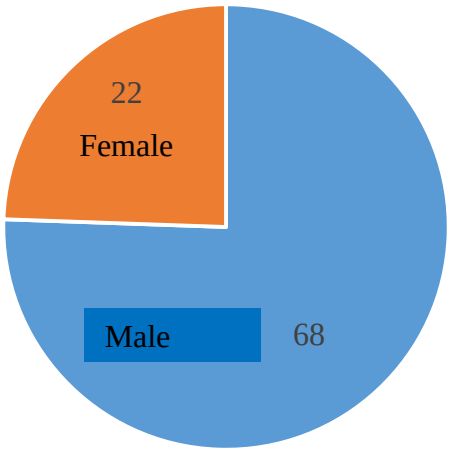
Note: Field Survey, 2024

4.1.2. Sex Ratio of Respondents

Out of the 90 people interviewed, 22 of them were female and 68 were male (Fig.7). This disparity may reflect the demographic composition of the responders, or the roles typically assigned during emergency responses. Case studies like this need to analyze the reasons behind such disparities to ensure inclusive and effective disaster response strategies.

Figure 7

Sex Ratio of the Respondents



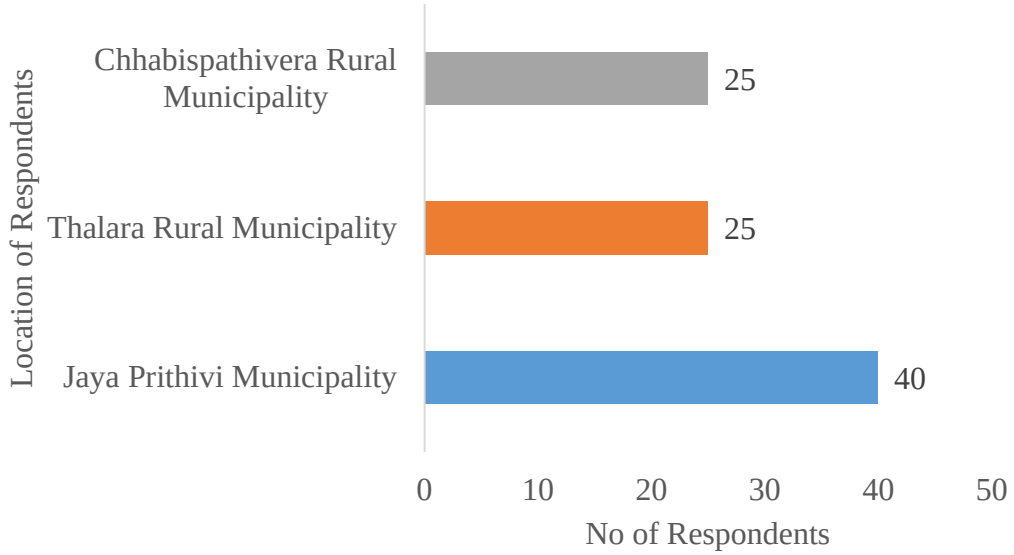
Note: Field Survey, 2024

4.1.3. Geographical Distribution of Respondents

Out of the total 90 respondents interviewed, the participants were from three different municipalities. Among them 40 respondents were from Jay Prithvi Municipality, 25 were from Thalara Rural Municipality and 25 were from Chhabispathivare Rural Municipality as shown in Figure 7. The distribution shows a higher number of participants from Jay Prithvi Municipality, which was various factors such as population size, the impact of the earthquake, or the focus of the study. The case study needs to consider the demographic and geographic diversity of the respondents to ensure a well-rounded understanding of the earthquake's effects and the efficacy of the response efforts.

Figure 8

Geographical Distribution of the Respondent



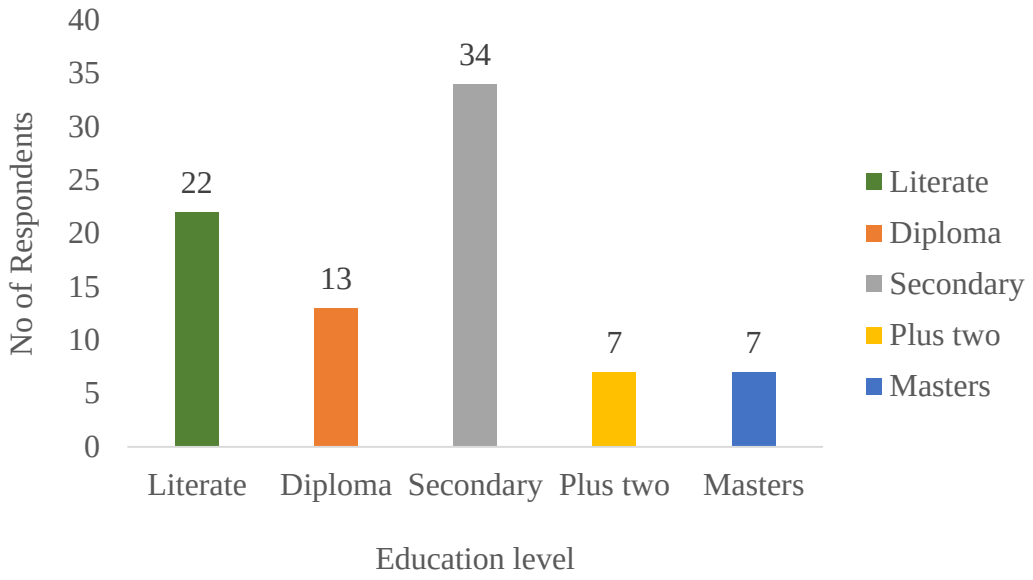
Note: Field Survey, 2024

4.1. 4. Education Status of Respondents

The participant's educational background in the Bajhang earthquake case study was distributed as follows: Literates, 24%, Secondary Education 38%, Plus Two (Higher Secondary) 8%, diploma 14% and master's degree 8% as shown in Figure 8. This data suggests a varied educational background among the participants, with a significant proportion having completed secondary education or higher. The presence of individuals with different levels of education can provide diverse perspectives and skills, which is beneficial for a comprehensive study. It's also noteworthy that the majority have at least a secondary education, which may influence the understanding and interpretation of the research questions and outcomes.

Figure 9

Education Status of Respondents



Note: Field Survey, 2024

4.1. 5. Major Hazards in Jayaprithivi Municipality, Thalara and Chabispathiva village Municipality

In the context of Nepal, earthquakes are the most deadly disaster, according to national disaster data. As far as natural disasters as flood, landslide, fire outbreak, road accident, attack by wild animals, and pandemic are among Nepal's main threats. Researchers questioned residents of Jayaprithivi Municipality about the main risks, using the questions listed in appendix "B". Within the framework of Jayaprithive Municipality, community members and a district administration office representative made the following claims:

> *Chainpur is surrounded by the Seti River, Bahuli River and numerous other drains and nalas, floods and landslides are considered to be the most common natural disasters in the area. According to statistics from home visits and community group discussions, the main disasters in Jayaprithivi municipality, according to 40 out of 50 respondents, are flooding and landslides. This*

> *indicates that about 90% of sample respondents have experienced a flood or landslide. Similar considerations were made in two other village municipalities, where 35 respondents out of 50 identified land slip as the primary cause of problems in their day-to-day activities. Nevertheless, Sudurpaschim Province has seen numerous earthquakes (4 to 4.5 magnitudes) in the recent five months. And, this study also finds that haphazardly road construction in rural areas is the main reason of landslide in present days in Bajhang districts.*

The study also finds Earthquake is repeatedly happen in Suduspaschim Province, Nepal in 2023.

4.1. 6. Understanding about Earthquake

Earthquakes are called "bhuichalo" in the native language. There is a lack of information about earthquakes in each of the three municipalities. Because they have lived through earthquakes in the past, people frequently do not care about the potential risks they pose. Many individuals of the society hold the prevalent beliefs and attitudes that earthquakes are uncontrollable natural occurrences. Additionally, some individuals believe that supernatural or spiritual powers are to blame for earthquakes.

How do you understand about earthquake?

> *Eighty-five percent of respondents know that an earthquake is a natural occurrence brought on by a spiritual or supernatural force. Nearly all emergency personnel are aware of the profound effects that earthquakes have had on the community, including destruction of property, fatalities, and interruption of livelihoods. Teachers, who make up 15% of the respondents, are aware that tectonic plate movement and interaction is what causes earthquakes. They are aware that there are regular earthquakes in the Sudurpaschim Province due to its location in a seismically active area. The KII Ram Datta Joshi, Red Cross head stated that "we are aware that aftershocks are little earthquakes that follow a larger earthquake, but this time it happened in an unfavorable way, with a 5.1 and 6.3 magnitude aftershock, respectively, and that they might linger for days, weeks, or even months after a major earthquake".*

The locals are aware that buildings, trees, and other things vibrate when there is an earthquake because the ground trembles. They know that there are different magnitudes

of earthquakes, some of which cause more intense shaking than others. They are also aware that occasionally, earthquakes can cause ground rupture, which is the splitting or cracking of the Earth's surface. They are aware of how earthquakes can affect infrastructure and structures. They are aware that shoddy or frail constructions are more likely to sustain damage or collapse during an earthquake. KII also recognize the importance of building codes and earthquake resistant construction techniques. 20% of the respondent from Jayprithivi Municipality, 15% from Thalara and 17% from Chabispathivara respondent that they know to "Drop, Cover, and Hold On" during the shaking and to move to open areas away from buildings, trees, and power lines.

4.2. Initiatives Taken before Earthquake by Jayaprithivi Municipality, Tharala and Chavispathivara Rural Municipality

The researcher's field visit revealed that many elements, such as institutional capability, awareness, infrastructure, and resource availability, could account for variations in the level of earthquake preparedness.

4.2.1. Government Preparation

The government of Nepal has implemented various initiatives to enhance earthquake preparedness across the country, including the Sudurpaschim Province. These include the development of building codes, the establishment of the National Society for Earthquake Technology (NSET), and the formulation of the National Disaster Risk Reduction and Management Framework. Deployment of security forces in Bajhang.

How many security personnel are in Bajhang and other thing stock in the district headquarters before earthquake?

> *KII Police District chief Bharat Shah stated that before earthquake in Bajhang district around 300 Nepal Police were available. The APF company commander Janka Pant stated that around 160 APF, Nepal personnel, among them, only six persons are trained and Nepal army company commander stated that around 220 Nepal Army, no trained personnel were available before earthquake and they do not have sufficient rescue equipment in the Unit. The Nepal Red Cross*

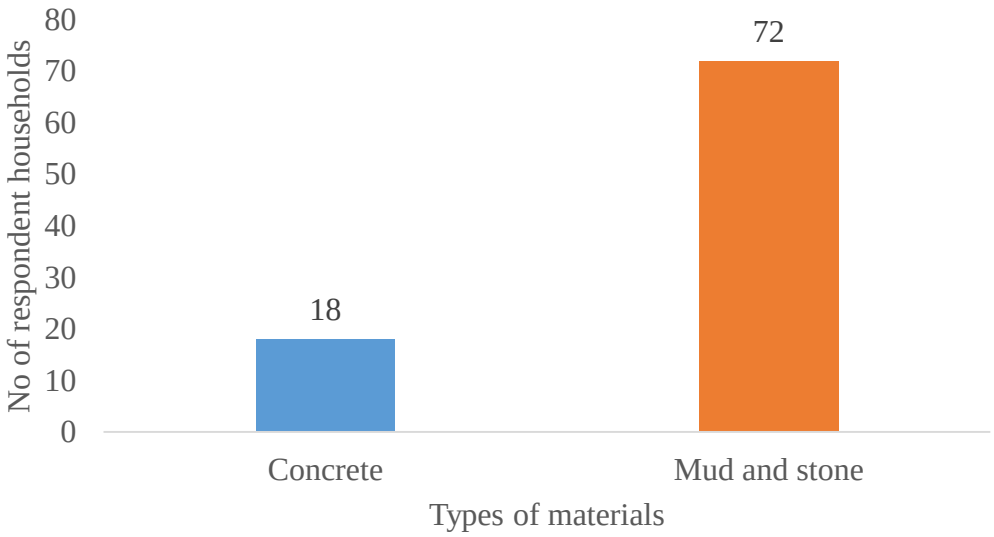
stated that before earthquake they have only tent and Kambal in stock for around 100 families. - A KII Respondent, Ram Datta Joshi

4.2.2. Materials use of Constructing Building

In Jayprithivi Municipality, Thalara and Chabispathivara rural municipality. Out of the 90 people surveyed, only 18 built their houses using concrete, while the majority of 72 used mud and stone as shown in Figure 9. This means that only 20% of respondents have houses made of materials that are considered strong against earthquakes, while 80% have houses made of materials that are weaker and more likely to be damaged during earthquakes.

Figure 10

Types of Materials used in House constructing before the Earthquake



Note: Field Survey, 2024

4.2.3. Building Infrastructure

Efforts have been made not to improve the earthquake resilience of buildings in study areas. The local government had not introduced guidelines for earthquake resistant construction of existing structures.

Are you applying Building Code and retrofitting system in your houses?

Out of 90 respondents, 75 said they were unaware of the Building Code and retrofitting methods. They were not even told about this by the local authorities. Six respondents from Municipality 5 and four from the village municipality said they were aware of the building code and retrofitting technique, but that they were not being used since there were not enough funds and no expert technicians available. KII, Municipality chief Chet raj Bajal stated that they do not have local law to implement it. He further stated that they will formulate law very soon. He further stated that people are not cooperating with us to construct open space in the market area due to the owner of local people.

As the researcher observation, in remote places mostly individuals are constructing mud and stone mix structures, those who were construction a concrete house in remote village they were not implementing the structures Code and any other safety measures. The majority of them are ignorant of it, and some are acting carelessly.

The Thalara Rural Municipality Chairperson Praksh Rokaya stated that we don't have any building code system to date. *We are drafting the "Local level Disaster Management Act*" and it will be implemented soon.

Without earthquake-resistant buildings, the structures in these areas are more prone to damage or collapse during an earthquake. This poses significant risks to the safety and lives of the residents. Buildings that do not adhere to seismic design principles have a higher likelihood of experiencing structural failures and can result in injuries or fatalities.

Building codes play a crucial role in regulating the design, construction, and maintenance of buildings to ensure their safety and structural integrity. The absence of a building code system means that there were no specific guidelines or regulations in place to ensure that buildings were constructed to withstand earthquake forces. The situation highlights the need for increased awareness and support for earthquake-resistant building practices in these areas. It is important to educate the local community about the benefits of earthquake-resistant construction and promote the adoption of building codes to enhance the resilience of structures against seismic events.

Efforts should be made to introduce and enforce building codes that incorporate seismic design principles in these municipalities. This would involve implementing regulations for new constructions and developing strategies for retrofitting existing buildings to improve their earthquake resistance. Collaborative initiatives involving local authorities, engineering professionals, and community members can help raise awareness, provide technical guidance, and allocate resources to address the lack of earthquake-resistant buildings and building code systems in these areas.

4.2.4. Community Awareness

Training courses and awareness campaigns have been held to inform the local populace about the risks of earthquakes and how to be prepared. The goal of these programs is to spread knowledge about emergency preparations, early warning systems, safe building practices, and first aid methods. Nonetheless, community members' awareness and knowledge levels can differ, so continuing outreach and education initiatives might be necessary.

Out of 90 respondents interviewed, 26 have participated in an earthquake awareness program previously while 64 have not as shown in Figure 10. This suggests that approximately 28.9% of the participants are aware and potentially prepared for an earthquake, while the majority, 71.1%**,** have knowledge gaps in this aspect. Earthquake awareness programs are crucial, especially in regions prone to seismic activity.

Is there any community awareness program conducted by government side in your community?

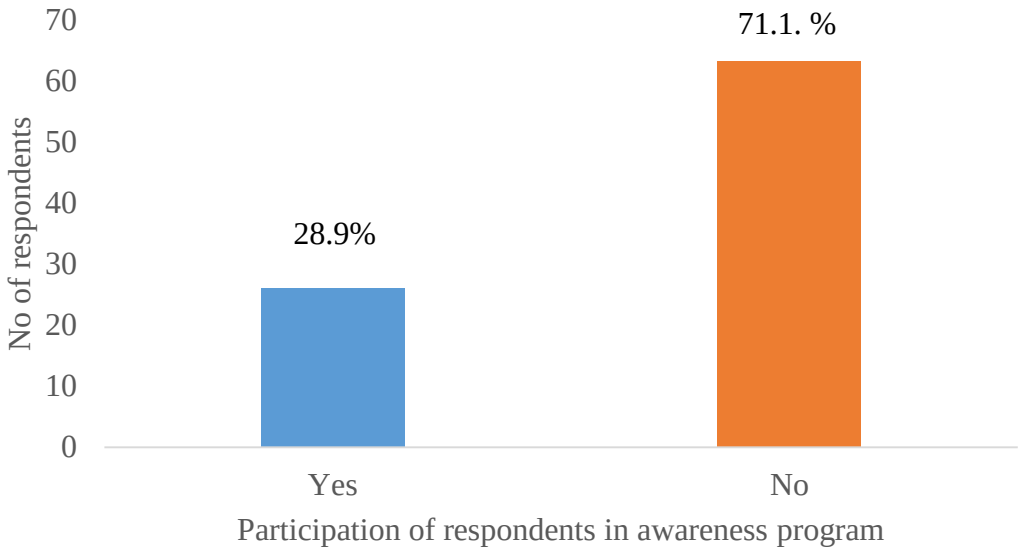
> *Mr Ram Bahadur thapa, 40 years old resident from Chainpur bazar, he took participants on monsoon related disaster preparedness activities conducted by security forces. There was few numbers of local participants on that program because people are not interested to participate like this program without any allowances. The KII Assistance CDO said that they have provided the awareness programme to people by the Red Cross and other stakeholders.*

The collected data showed that in local level there is a low level of public awareness programme conducted by the concern agencies, people were not much aware of the programme. The below table showed that 71% people have knowledge gap which not

good sign for government for future. The government should much concern about this issues

Figure 11

Participation of Respondents in the Awareness



Note: Field Survey, 2024

4.2.5. Disaster Awareness programme by Development Agencies

Development agencies play a crucial role in disaster awareness programs by promoting disaster risk reduction (DRR) initiatives and enhancing community resilience. These agencies work towards raising awareness among decision-makers, community leaders, and the general public about the importance of disaster risk reduction and preparedness. They focus on advocating for proactive measures to mitigate the impacts of disasters, emphasizing the need for good governance in disaster risk reduction efforts.

The main role of development agencies in disaster awareness programs is to foster a culture of preparedness, promote sustainable development practices, and facilitate the integration of disaster risk reduction measures into relief and development planning. Their efforts aim to minimize the impact of disasters, protect lives and livelihoods, and safeguard development gains in vulnerable communities. The figure 12 shown the awareness program conducted by the agencies.

Table 4

Awareness programme by Development Agencies

Agencies	2077/2078	2078/2089	2089/2080
Red cross	4	3	3
UNDP	3	3	2
UNMIN	4	2	2
World vision	3	3	1
WPF	5	3	4

Note: NRCS (2024)

The above data showed that the Red Cross has consistently provided disaster awareness programs, while UNDP, UNMIN, and World Vision have shown a declining trend in their involvement over the years. In contrast, WFP has maintained a strong presence, highlighting the importance of sustained efforts in disaster awareness. The data emphasizes the need for consistent and long-term commitment from development agencies to promote disaster preparedness and resilience in Nepal.

4.3. Mitigation Strategies

Ninety percentages of respondents said that they were unaware of non-structural mitigating options. When questioned, persons who experienced the 2015 earthquake appeared to be unfamiliar with the technical phrase "non-structural mitigation," yet their actions revealed that they had taken care of securing interior movable things.

Have you any experience from past earthquake, if yes then you applied any structural mitigation measures to safe your house?

> *The 2015 earthquake caused damage to my residence. We left the home and spent the night with my neighbor house, whose residence is on the north side of my house. The KII Red Cross chief stated that people were could not lesson learn from the 2015 earthquake, they forget everything. The mayor of Jayprithivi Municipality stated that sorry to say that the local market people could not visit the Municipality office to before constructing their house.*

Chabispathivara village chief said that the other two village municipality had facing same problem.

4.3.1. Earthquake Plans

95% respondents stated that they don't have any plans about the earthquake preparedness procedure. Campus Chief Dirgh pandit and other teacher said that they sets plans and talked to his family.

I learned a few things from the 2015 earthquake, and I also participated in a District Administration Office orientation session. I relocated my mother's room to the bottom floor following the 2015 earthquake. Since my mother needs assistance walking, this is done to allow time for an emergency evacuation.

Using a selected sample, this study found that 95% respondents did not consider planning ahead for the vulnerable or being prepared for earthquakes.

4.3.3. Emergency Kit box

Every reply acknowledges that the KII was ignorant of the GO BAG and a fire extinguisher.

The heads of the Red Cross and KII campus chief knew about the GO BAG, but 88 people had never heard of it. The children of those two respondents told them about the GO BAG.

Eighty percent of respondents stated they had never thought about installing a fire extinguisher in their home, while the remaining twenty percent indicated they already had one since it is a need. A shovel, pick, bucket, hammer, and torchlight are among the typical tools that all of the respondents did own, but these are more appropriate for household tasks like gardening than for use in an emergency rescue.

4.3.4. Stock Ration

When questioned about stock rationing, most respondents indicated they had enough food (rice, wheat, maize, millet) for a month, though the earthquake damage was our

stock ration. On the other hand hailstone damage our cultivate land which will be more suffer for us in coming days. And very few said they had enough for more than a month.

> *People are a lot of suffering from the earthquake in agricultural sector. People had stoke ration though the incident had damage the food item, on the other hand due to the hailstone the agriculture sector was badly affected. –.KII Assistant CDO Satya Joshi*

4.3.5. Safe Places

The majority of responders had no idea about open spaces around the study location. A small number of responders from Chainpur bazar revealed the locations of the shelters they sought refuge in during the 2015 earthquake, which were situated on the grounds of School. It was discovered throughout this research that there aren't many open places in the school grounds that can accommodate an average of 10 to 12 families, but the local authorities must also be aware of this. During an interview, key informants were unable to mention the existence of an open area on the school grounds.

> *Mayor of jayaprithivi Municipality stated that in chainpur market area there is no open space available. All the market area belongs to private owner. They are not cooperate to local government. Before one year we have football ground near the Bahuli River but the flood had destroy it. But we have enough space in school areas.*

> *Ward person of Thalara rural municipality stated that we have enough space in school. We have no problem in for open space in our rural municipality.*

> *The chairperson Chabispathivara Basant Bahadur Chalaune stated that they have enough space in school areas.*

4.3.6. Community Preparedness

According to the Federal Emergency Management Agency (FEMA) (2021), community collaboration is essential for readiness. This includes locating talent, identifying populations that are at risk, and educating people about the dangers and risks that exist in their neighborhood. Even after doing door-to-door surveys on behalf of CBDRM (Community Based Disaster Risk Management) members in a few specific regions or at the local government's request, they are still unable to reach a wider

audience. Forty responders from three nearby towns stated they were unaware of or had not taken part in any community-related projects. They all claimed not to know anything about preparing locally. Thirty respondents said they would prefer not to take part in any of the community events because they are too busy.

> *We try to have meetings once a month, but sometimes it's not feasible because the "samiti" members aren't always available. We frequently discuss issues such as construction projects, health shelters, safe drinking water availability, and other topics in our meetings. We never address catastrophe preparedness because we have more important matters to attend to, such drainage problems, a lack of clean drinking water, and other topics. .A Tole Sudhar. Samit Jayaprithavi Municipality – FDG*

4.4. Possible Causes of Earthquakes Damage

The vulnerability of the regions in terms of building construction and disaster risk reduction can be attributed to various factors, including geographical conditions, poor infrastructure, the absence of building code systems, lack of awareness, socio-economic conditions, and limited engagement in disaster risk reduction (DRR) activities.

Table 5

Causes of Respondents opinion the 2023 Bajhang Earthquakes Losses and Damage

Causes of frequent earthquakes	No of respondents (%)
Geographical Condition	10
Poor infrastructures	35
Absence of limits use of building code	10
Lack of awareness	25
Socio-economic conditions	10
Limited engagement in building back a better approach	10

Note: Field Survey, 2024

Table 4 showed the respondents opinion in the causes and earthquake loss and damage. Out of the total 90 respondents, 10% of respondents said that an area's vulnerability and resilience to natural catastrophes like earthquakes are significantly shaped by its

geographic location, particularly in those that are in seismically active zones. The geological characteristics of these areas, such as proximity to fault lines or unstable soil conditions, can further amplify the risks associated with seismic events.

Thirty five percentage of respondents stated that poor infrastructure exacerbates vulnerability to earthquakes. Inadequate housing structures, including those constructed with mud or clay, lack the necessary structural integrity to withstand seismic forces. Insufficient investment in infrastructure development, including roads, bridges, and utilities, further hampers effective disaster response and recovery efforts.

Another 10% of respondents stated that the absence or limited application of building coding systems is another contributing factor. Building codes provide guidelines and regulations for safe and resilient construction practices. The lack of such codes or their inadequate enforcement can lead to substandard construction, leaving buildings more susceptible to damage or collapse during earthquakes.

Similarly 25% of respondents stated that a lack of awareness regarding the importance of seismic-resistant construction techniques and materials is a significant challenge. This can stem from limited access to information, educational resources, or training programs. Insufficient awareness among homeowners, contractors, and local communities can result in the continued use of vulnerable building materials and construction practices.

Ten percentage of respondents stated that socioeconomic conditions can also influence vulnerability. Disadvantaged communities with limited resources may face challenges in accessing safer construction materials and technologies. Economic constraints can hinder the adoption of resilient building practices, reinforcing the use of cheaper but less earthquake-resistant materials.

Similarly, 10% of respondents stated that the limited engagement in DRR builds back better activities that contribute to vulnerability. Effective disaster risk reduction requires proactive measures, such as hazard mapping, early warning systems, emergency preparedness, and community engagement in mitigation and response efforts. The lack of participation and coordination among stakeholders can hinder the implementation of effective DRR strategies, leaving communities ill-prepared for

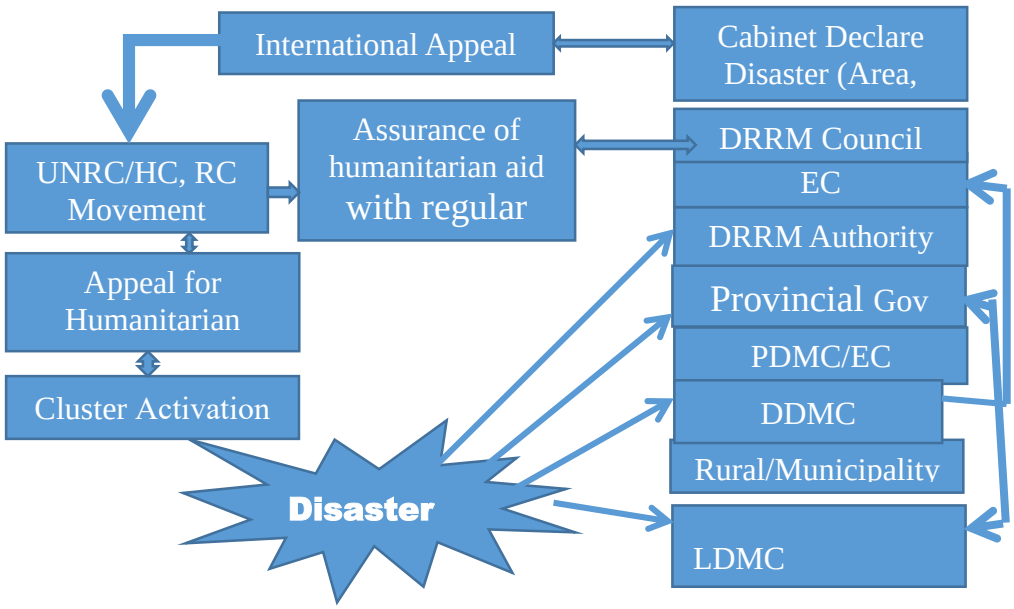
earthquake events. The vulnerability of the regions to earthquakes and the poor performance of mud or clay constructions can be attributed to a combination of factors.

4.5. Disaster risk Reduction and Response

The national response and coordination law in Nepal is governed by the Disaster Risk Reduction and Management Act, 2074, and Disaster Risk Reduction and Management Rules, 2076. Nepal has aligned its disaster management efforts with the Sendai Framework for Disaster Risk Reduction 2015-2030. The National Disaster Response Framework (NDRF) in Nepal was first developed in 2013. The national assistance and coordination structure shown in figure- 12 which is mention on it. After the sandai framework came into the existence NDRRF was revised in 2019 by the Executive Committee for Disaster Risk Reduction and Management.

Figure 13

National Assistance and Coordination Structure



Note: NDRF (2019), the National coordination and Response Structure

The above figure covered various aspects such as natural and non-natural disasters, District and Provincial Disaster Management Committees, disaster risk reduction, recovery, response, overall disaster management, business establishments, public entities, security agencies, and Local Disaster Management Committees. These laws

aim to ensure effective coordination, response, and management of disasters at various levels within Nepal.

4.5.1. Security Forces Response in Bajhang Earthquake

The response of security forces in Bajhang district the earthquake in 2023 involved their deployment for search and rescue operations within an hour. The NDRF 2013 clearly mentioned that security forces should deployed an hour after disaster. Local administration body deployed security forces to assist in search and rescue efforts in the aftermath of the earthquake in Bajhang. This deployment was part of the overall response operation to address the immediate needs and ensure the safety of the affected population.

> *The CDO stated that we respond the earthquake very quickly with in one and half hour the security force able to open the life line of Bajhang district. The APF, Nepal Personnel had recovered death from landslide in the roadside of ward No 11.-KII*

The following table -5 for deployed personnel during the earthquake

Table 6

Numbers of Security Personnel Deployed in Earthquake

SN	Security Force	Number
1	Nepal Army	45
2	Armed Police Force	120
3	Nepal Police	250
4	NID	12
Total		**427**

Note: District Administration Office, Bajhang, (2024*)*

In total, 427 security personnel were deployed to Bajhang to ensure the safety, security, and coordination of rescue and relief efforts in the earthquake-affected region. The combined efforts of these security forces aimed to provide a sense of safety and order, facilitate rescue operations, and support the overall response and recovery efforts in the impacted areas.

4.5.2. Humanitarian Response

The key measures taken by the Government of Nepal include the transfer of NPR. 50,000 to each household with completely damaged structures, to be distributed in two instalments incorporating the minimum standards necessary for shelter construction. The first installment has been released. Additionally, the Government will also provide free medical treatment to those injured in the earthquake across all hospitals and provided NPR. 200,000 to the families of those killed in the earthquake. The following agencies were deployed on support to disaster victims.

> *The NGos chief of Bajhang district stated that we coordinated with CDO for the sake of disasters victims from humanitarian prospective.*

Table 7

Development agencies working on Support in Earthquake, Bajhang

SN	Agencies	Fields
1	People in Need	Hygiene
2	Marcy corps	Food livelihood
3	UNDP	Recovery
4	WFP	Food
5	IFRC	Basic services
6	UNFPA	Health
7	UN Mission to Nepal	Education
8	UNICEF	Protection
9	World vision	Shelter
10	Save the children	Shelter and hygiene kit

Note: DEOC,Bajhang(2024), INGos and NGos Working together in the Field after the Earthquake, Bajhnag

In the aftermath of the devastating earthquakes that struck Bajhang, 2023, various organizations and government agencies came together to provide immediate relief to the affected communities through one door policy.

> *The CDO stated that we manage all those things in coordinated manner. The local administration was very aware of duplication of work. That is why we made decision on DDMC meeting for one door policy. -KII*

Save the Children was one of the first responders, delivering essential aid within 72 hours in Bajhang. They provided shelter and hygiene kits to 200 households in Bajhang, directly benefiting over 5000 people. Save the Children also distributed food items to 200 households. Mercy had supported food livelihood initiatives for the 200 household affected individuals. WPF had provided food assistance to 200 people impacted by the earthquake. United Nations Population Fund was focused on health-related support for the victims which was Provided health service to 670 households. UN Mission to Nepal Contributed to educational initiatives in the earthquake-affected areas. They provide the 20 schools educational support after the earthquake in Bajhang. UNICEF was provided protection services to 850 vulnerable people in the aftermath of the earthquake.

UNDP played a significant role in the recovery process. They officially handed over 40 temporary shelters to vulnerable community members in Bajhang and collaborated with the Ministry of Industry Tourism Forest and Environment to lead the Early Recovery cluster at the provincial level. UNDP also provided data and information management support through the deployment of officers at the provincial, district, and municipal levels. The Government of Nepal took several measures, including providing free medical treatment to the injured, financial assistance to the families of those killed, and cash grants to households with completely damaged structures.

4.5.3. Relief Operation after Disaster by Security Forces

The security forces in Nepal, including the Nepal Army (NA), Nepal Police (NP), and Armed Police Force (APF), have played a crucial role in relief operations during disasters. Nepal's security forces have consistently responded to disasters, demonstrating their commitment to saving lives and supporting affected communities during crises. Their efforts are crucial in the immediate aftermath of disasters when time is of the essence for successful rescue and relief operations.

NP and APF, Nepal had managed chaos, criminal activities, and fear among citizens during the disaster period to maintain peace and security. They worked closely with local government and humanitarian organizations in coordinating relief effort. Both security forces had helped to constructing the temporary shelter of the victim. Nepal

army had provided first aid to the injured and medevacked the seriously injured to hospitals in local hospital. The army used their rescue and medical teams to affected areas.

4.5.4. Humanitarian Assistance to Victim

Over ten development agencies, including Save the Children, World Vision, and different UN agencies, were mobilized to give assistance and support following the 2023 Bajhang earthquake. Shelter, hygiene, and winterization supplies distributed immediately to thousands of impacted households. Establishment of Child-Friendly Spaces and Temporary Learning Shelters to promote children's well-being and education. Distributing dignity kits and providing psychosocial help. WASH programs include hygiene kit distribution, temporary toilet construction, and hygiene promotion. Agencies worked together with the government and local partners to provide a coordinated and effective response that reached even the most remote locations. However, issues such as the government's one-door policy for assistance distribution caused delays in some cases.

> *The respondent stated that the prime minister announced that the government will evaluate the earthquake's damage as soon as possible and then gather information about the number of buildings that will need repair, retrofitting, or reconstruction. "Depending on the size of the family, an immediate relief amount ranging from Rs15, 000 to Rs20, 000 will be given but he could not fulfill the promise. The respondent stated that the government only provided the 15000 and JASTA PATA which is not enough for our daily actives.*

> *One of the respondent Janak raj joshi from jayaprithivi Municipality, Subeda-7 stated that the local authority distributed the relief item on the basis of political power which is not fair. People are struggling for basic needs.*

> *The Red Cross Chief Ram Datta joshi claimed that the Red Cross and other agencies provided Joshi provided the tents, JASTA PATA a for immediate shelter needs. But people are not using temporary shelter and they used their*

old cracked house. It will bring devastating consequences if again disaster happen. - KII

The CDO stated we are providing financial assistance and other support on the basis of recommendation letter of local authority- KII

The following are the fund and other necessary item provided by the government and local agencies to victims.

Table 8

Fund for Temporary Shelter Construction for Victim

SN	Municipality	Fund Received from NDRRM	Installment Received by victim	First Installment	Second Installment
1	Jayprithivi Municipality	250 Million For all twelve palika	1275	31875000	31050000
2	Thalara Rural Municipality		705	17625000	
3	Chabispathivara Rural Municipality		350	8750000	

Note: DEOC, Bajhang, (2024)

The government provided funds to local authorities for quick relief to victims from Janapa, Thalara, and Chabispathivara following an earthquake. The allocated amounts were Rs. 31,875,000 for Jayprithivi Municipality, Rs. 17,625,000 for Thalara, and Rs. 1,275,000 for Chabispathivara. These funds were part of the immediate disbursement of relief funds authorized by the government to aid the earthquake victims in these areas. The government's response included providing financial support to the affected areas to facilitate search and rescue efforts and aid in the rehabilitation of the impacted communities.

Table 9

Relief Item Distributed to the Victim

item/Municipality	Jayprithivi	Chabispathivara	Tharala
Tripal	60set	48set	68sets
Tent	sets	5 sets	5 sets
Kamal	12 sets	12 sets	12 sets
Balket	8pic	8sets	8sets
Noddle	2 cartoon	2 cartoon	2 cartoon
Biscuit	7 cartoon	7 cartoon	7 cartoon
Mattress	7 bundle	7 cartoon	7 cartoon

Note: DDMC, Bajhang, (2024)

While the quantities provided may not be sufficient to meet the needs of all victims, these relief items offer some comfort and support in the aftermath of the earthquake. The government's efforts to provide these essential supplies demonstrate their commitment to assisting the affected communities during this challenging time.

To analyze the above data indicates that the government, along with various organizations like the Nepal Red Cross, Save the Children, and international agencies, provided relief items to the local people affected by the earthquakes in Bajhang, The relief efforts included the distribution of emergency shelter items, food support, winterization tents, transitional shelters, hygiene kits, cash transfers, and various other forms of assistance to address the immediate needs of the affected communities.

4.5.5. Coordination between Security forces and other Stakeholders

An efficient disaster response and recovery strategy during the Bajhang earthquake required close cooperation across all parties involved. Together, a number of governmental and non-governmental groups worked closely to solve the pressing issue and offer assistance to the impacted populations. In order to successfully meet the urgent needs of the affected people, the Disaster Risk Reduction & Management response stressed the significance of collaboration, evaluation, and coordination among stakeholders. In Bajhang, Save the Children, the Red Cross, and other organizations

swiftly acted to offer life-saving aid, including winterization tents, food support, shelter, education support, protection services, and WASH programs. This cooperative effort made sure that vital supplies of relief arrived quickly to the impacted population, lessening the effects of the disaster and assisting with recovery efforts.

> *Dirgh Pandit campus chief stated that people are very trust with security force have swiftly conducted the rescue and relief operation in their community. Though the security officer agree that they could not reach on time remote places due to some limitations*- KII

> *The CDO stated that we have good coordination between security forces and other stake holder during the reuse time. Within the hour two and half hour we success to open the MSR that was only possible because of high level of coordination between security forces- KII*

4.5.6. Community Engagement

> *According to the respondents from Jayaprithivi municipality, Thalara, and Chabispathiviara in Bajhang district, the community response during the earthquake was prompt and crucial. 70% of the respondents from Jayaprithivi municipality, 90% from Thalara, and 85% from Chabispathiviara stated that their neighbors were the first to arrive for rescue efforts.*

The immediate response from neighbors the strong sense of community and solidarity in Bajhang district during times of crisis. The fact that neighbors were the first to respond underscores the importance of local support networks and the willingness of community members to come together to assist one another in times of need. This rapid and collective response from neighbors played a vital role in providing initial assistance, support, and comfort to those affected by the earthquake, showcasing the resilience and unity of the community in Bajhang district.

4.6. Obstacle after Post Disaster

Question regarding obstacle faced local community given and according to the respondents faces obstacles after the earthquake faced by local community are as follows:

4.6.1. Poverty and Socio-Economic Factors

More than 50 percent responder of Jayaprithivi Municipality, and other two village municipality, Bajhang stated that they are facing economic challenges and struggle with poverty. Due to the poverty, their ability to invest in earthquake-resistant infrastructure, retrofit existing buildings, or procure essential supplies for emergency preparedness is less. Socio-economic factors also affect access to education and information, which may impact the level of awareness and understanding of earthquake risks and preparedness measures.

4.6.2. Cultural and Traditional Practices

During KII and FGD, it was find that cultural and traditional practices influence the adoption of modern earthquake preparedness measures. In some cases, traditional building techniques may not adhere to current seismic safety standards, which can increase the vulnerability of structures during earthquakes. Even in market area there were poor constructed old houses, but they do not make it retrofit because they believe their ancient and it was the respect of their ancient.

4.6.3. Lack of Awareness and Education

During field visit it was observed and feels by interviews that local people have limited access to education and awareness programs about earthquake risks, preparedness measures, and response protocols hinder community members' ability to effectively respond to earthquakes. Insufficient knowledge about evacuation procedures, first aid, and other safety practices increase the vulnerability of the local community.

4.6.4. Limited Resources

As per the Key Informant Interview (KII) and almost ninety percent responder stated that the Jayaprithivi Municipality,Tharala and Chabispathivara village municipality often lacks adequate financial, technical, and human resources to implement comprehensive earthquake preparedness measures. Limited funding and infrastructure hinder the development and maintenance of early warning systems, the implementation of building codes, and the provision of necessary equipment and resources for emergency response.

4.6.5. Geographical Condition

Ninety percent responder stated that, Bajhang districts is remote and hard-to-reach areas, which pose logistical challenges for delivering aid and support during and after earthquakes. The inaccessibility of certain wards delay emergency response efforts and limit the availability of critical services, such as medical assistance and search and rescue operations.

4.6.6. Limited Infrastructure

Almost all responder stated that, Jayaprithivi Municipality's infrastructure, including roads, bridges, and communication networks, are inadequate or poorly maintained. This can hamper the efficient delivery of aid and support during emergencies, hinder evacuation efforts, and impede coordination among different stakeholders involved in disaster response.

Among them Researcher observed that there were lack of young people in community, who are the first responder in disaster and people are not interested to participate in disaster preparedness activities. Local government and other related agencies have limited resources to conduct preparedness activities in the community. To make more participants of local people in disaster preparedness activities, it is needed some allowances for them but the related agencies have not sufficient budget. To addressing these challenges requires multi-stakeholder collaboration, including involvement from government agencies, NGOs, local communities, and international organizations. It is crucial to prioritize resource allocation, capacity building, community engagement, and

awareness raising initiatives to enhance earthquake preparedness in the Sudurpaschim Province, Nepal and promote community resilience in the face of seismic hazards.

4.7. Initiatives Should the Government Take to Reduce Future Losses

Reduce future losses from disasters like the 2023 Bajhang earthquake, the government should take the following key initiatives: Building capacity, giving financial support, and giving structural and non-structural mitigation projects top priority are all ways that the government can drastically lower future losses from earthquakes and other natural disasters. Improving the resilience of the country requires a thorough, multi-stakeholder strategy.

Table 10

I*nitiatives that the Government should take for Disaster Management.*

Initiatives	**No of respondents (%)**
Raising awareness	30
Effective Coordination and Collaboration	25
Enforcement of Law and Building Code	20
Streamlined and one-door policy for the recovery process	25

Note: Field Survey, 2024

The respondents stated that to improve earthquake resilience in Bajhang, key factors include raising awareness, coordinating stakeholders, implementing building code laws, reducing political interference, promoting transparency, mapping, and town planning, planning for rural house construction, monitoring, providing training, and capacity building, implementing a one-door policy, and preventing disaster tourism. These measures collectively contribute to safer construction practices and more effective disaster risk reduction and recovery processes.

Thirty percentage of respondents stated that the level of awareness about earthquake resilience-building practices is crucial for promoting safer construction methods. Efforts should be made to raise awareness among the general population, builders, and

relevant stakeholders. This could include awareness campaigns, educational programs, and the dissemination of information through various channels. The respondent further stated that providing training programs for engineers, architects, builders, and communities on earthquake resilience principles and practices is essential. This enhances the capacity of individuals and organizations to implement appropriate measures during construction and post-disaster recovery.

Another 25 % of respondents stated that effective coordination and collaboration among different stakeholders, including government agencies, NGOs, communities, and private sector entities, are vital for implementing earthquake resilience measures. This involves establishing platforms for communication, fostering partnerships, and promoting participatory decision-making processes.

Similarly, 20% of respondents stated that the implementation and enforcement of laws and regulations related to building codes and construction practices are essential for ensuring earthquake resilience. This requires strong governance, monitoring mechanisms, and penalties for non-compliance. The respondents further stated that Comprehensive mapping of hazard-prone areas, land-use planning, and urban design considerations can contribute to earthquake resilience. This involves identifying safe building locations, implementing setback regulations, and considering geological and topographical factors in town planning.

Again 25 % of respondents stated that implementing a streamlined and efficient one-door policy for disaster risk reduction and recovery processes can reduce bureaucracy and enhance coordination among relevant agencies and stakeholders.

Respondent stated that political interference can hinder effective decision-making and implementation of earthquake resilience measures. It is important to minimize political interference and ensure that technical expertise and evidence-based approaches guide policy and implementation processes. Respondent stated that transparency in decision-making processes, resource allocation, and project implementation is crucial for building trust among stakeholders and promoting accountability. This includes transparent procurement processes, disclosure of project information, and public access to relevant data.

Preventing disaster tourism refers to the efforts and measures taken to discourage and mitigate the negative impacts of tourism in disaster-affected areas. It involves implementing strategies and guidelines to ensure that resources, attention, and assistance are directed towards the recovery and well-being of the affected communities, rather than being exploited for tourism purposes. By preventing disaster tourism, the focus can shift towards supporting the affected communities and facilitating a sustainable and respectful recovery process.

While the specific percentages would require data, considering these factors and addressing them collectively can contribute to improving earthquake resilience. It is important to tailor interventions to the local context and engage all stakeholders in the process for sustainable and effective outcomes.

4.8. DRRM Status in Bajhang

Now the situation in Bajhang suggests that the area is in the recovery phase, with the government continuing to provide help. Notwithstanding these endeavors, obstacles persist in the development and execution of legislation aimed at efficiently managing calamities. There doesn't seem to be a structured approach to disaster mitigation by the local administration, either in terms of structural or non-structural measures.

People in Bajhang still appear to be in need of government relief assistance, suggesting that the recovery efforts there are still underway. But it's clear that there isn't a systematic approach to disaster risk reduction, which calls for more planned, strategic initiatives to improve preparedness and resilience against future disasters. Given the region's susceptibility to seismic activity, a more proactive and all-encompassing strategy to disaster management is required to guarantee the population's safety and well-being.

> *According to the chairs of the Jayprithivi Municipality, Tharala Raural Municipality, and Chabispathivara, none of them have a local plan for reducing the risk of disaster. They are attempting to construct a near feature. There is currently no building code procedure in place. However, they established a fund for disaster management-KII*

If the major earthquake in this region could result in significant structural damage, casualties, displacement, geotechnical impacts, and secondary effects, highlighting the critical need for robust disaster preparedness, mitigation measures, and effective response strategies to minimize the impact and protect the lives and well-being of the population.

4.9. Discussion

The discussion of major findings analyzed in this part. It discussed research areas finding of Bhajhang earthquake that has a significant impact on human life. The disaster is not limited to the country itself but also beyond the country, mostly in different parts of India as Deheradun, Delhi and other Uttar Pradesh Disaster induces human casualties, infrastructure damage, and other impacts on society which are usually phenomena in the universe due to the disaster. Nepal lies in one of the most fragile eco-regions of the world and is prone to natural disasters. The country is highly prone to natural hazards such as floods, landslides, and fires, extreme weather events, including thunderstorms, epidemics, cold waves, GLOF, and earthquakes. In the context of earthquakes Nepal lies in the 11^{th} position in the world due to the high hazard, high vulnerability, low capacity, and high exposure (Lamsal et al., 2017).

On 3 October 2023, an earthquake of Mw 5.3 followed by another Mw 6.3 struck the Bajhang district of Nepal killing 1 person and injuring 25 others. Approximately 65,000 people (14,430 households) have been displaced across seven districts of far western province of Nepal. The earthquake not only affected Bajhang district, but it severely affected other neighboring districts and the tremors were felt as far as Delhi in India (IFRC, 2023).

4.9.1. Discussion on Initiatives before Earthquake

In research areas Flood, Landslide, Fire Outbreak, Road Accident, Wild-animal attack and pandemic are taken as the major prominent hazards in Bajhang district. Before earthquake in Jayprithivi Municipality 90% respondent was saying that land side and Seti River and Bahuli River creating the problem. On the other hand, two other village municipality 95% respondent is saying that they are suffering from landslide before earthquake,

Now the local population of one municipality and other two village municipality people was suffering from earthquake, especially in the DALIT areas those who have lower level of socio economic condition. The theory of culture, poverty align in Bajhnag earthquake. Assis Dias etal (2020) stated that People living in poverty are less likely to carry out necessary actions to mitigate hazardous effects. The researcher is also observing that where the poverty is, there is more effecting by disaster. Bista (1991) stated that the Sudurpaschim Province has a rich history and culture, with many indigenous communities and ethnic groups. Researchers could explore the history and traditions of these communities, as well as their social organization, customs, and belief systems

The company commander of APF is saying that they have, only six persons are trained personnel. Same situation in Army as well. Which is very less number for operation. If such types of disaster could occur in future.

In Jayapritivi municipality Out of 40 respondents, 85% said they were unaware of the Building Code and retrofitting methods. And other two village municipality respondent were not aware of the building code and retrofitting method. It means that the knowledge gaps in this aspect. Earthquake awareness programs are crucial, especially in regions prone to seismic activity. The government should initiation on this matter.

90% respondents said that they were unaware of non-structural mitigating options. 95% respondents stated that they don't have any plans and don't talk to their family about the earthquake preparedness procedure. More than 90% of the respondent is saying that ignorant of the GO BAG and a fire extinguisher.

The majority of responders had no idea about open spaces around the study location. A small number of responders from Chainpur bazar revealed the locations of the shelters

FDG in Jayaprithivi Municipality said they do not know anything about getting ready locally. Among them 70% percentage respondents said they would prefer not to take part in any of the community events because they are too busy. Analysis of the disaster preparation of the government in response to the hazards faced in Bajhang district reveals several key insights and areas for improvement

The research findings indicate a significant lack of awareness and preparedness among the local population, with high percentages of respondents unaware of building codes, retrofitting methods, non-structural mitigating options, and essential items like GO BAGs and fire extinguishers. This highlights a critical gap in disaster education and readiness at the community level.

The response from the government, as reflected in the statements by the company commander of APF and the Army, reveals a concerning shortage of trained personnel for disaster operations. This deficiency in manpower could severely hinder effective response efforts during disasters, especially considering the multiple hazards identified in the region.

The lack of knowledge about disaster preparedness measures, non-structural mitigation options, and essential items among the respondents underscores a broader issue of ignorance and unpreparedness within the local population. This ignorance poses a significant risk during disasters and emphasizes the urgent need for comprehensive awareness programs.

The findings suggest that a considerable portion of the population, particularly in Jayapritivi municipality and other village municipalities, is disengaged from disaster preparedness activities due to various reasons, including lack of awareness, busy schedules, and a preference not to participate in community events. Overcoming these challenges and fostering community involvement is crucial for enhancing overall disaster resilience.

The government's role in disaster preparedness is pivotal, as highlighted by the need for initiatives to address the identified knowledge gaps, promote awareness, and ensure the availability of resources and trained personnel for effective response. The government should prioritize earthquake disaster preparedness through the implementation of building codes, awareness campaigns, and training programs for local masons.

In nutshell, a pressing need for the government to take proactive measures to address the gaps in disaster preparedness, enhance community engagement, and strengthen response capabilities to mitigate the impact of various hazards in Bajhang district effectively. By prioritizing education, training, and resource allocation, the government

can significantly improve the overall resilience of the region and safeguard the well-being of its residents during disasters.

4.9.2. Discussion on Cause of Earthquake Damage

The frequent earthquakes and high probability of human loss, damage to infrastructure, and property in Bajhang district can be attributed to several factors, as indicated by the respondents. These factors align with the Pressure and Release (PAR) model, which provides a framework for understanding the progression of vulnerability and exposure to hazards.

The geographical difficulties, with 10% of respondents citing the hilly and mountainous terrain, contribute to the susceptibility of Bajhang to seismic activities. This geographical challenge exacerbates the risks faced by the population, increasing the probability of human loss and infrastructure damage during earthquakes.

Poor infrastructure, as indicated by 35% of respondents, plays a significant role in amplifying the impact of earthquakes. Poorly constructed buildings and roads are more vulnerable to seismic activities, resulting in higher levels of damage and loss during earthquakes.

The absence of limits on the use of building codes, as mentioned by 10% of respondents, contributes to the vulnerability of structures to earthquakes. Without proper adherence to building codes, buildings are not designed to withstand seismic forces, increasing the risk of damage and collapse during earthquakes.

The lack of awareness among the local population regarding earthquake preparedness and safety measures, as stated by 25% of respondents, is a critical factor leading to higher human loss and property damage during earthquakes. Insufficient knowledge about safety protocols and mitigation strategies hampers effective response and increases vulnerability.

The socio-economic conditions in Bajhang district, particularly in vulnerable communities, as mentioned by 10% of respondents, impact the ability of individuals to prepare for and recover from earthquakes. Poverty and limited resources hinder access

to safe infrastructure and resources, exacerbating the impact of seismic events on the population.

Limited engagement in adopting a proactive approach to rebuilding resilient infrastructure and communities post-disaster, as indicated by 10% of respondents, contributes to prolonged vulnerability. Without a comprehensive strategy for reconstruction and resilience-building, the district remains at risk of recurring damage and loss during future earthquakes.

To address these critical factors in the near future, a multi-faceted approach is required, including implementing and enforcing strict building codes, enhancing public awareness and education, improving infrastructure to withstand seismic activities, addressing socio-economic disparities, and promoting community engagement in rebuilding efforts. By prioritizing these measures and fostering collaboration between government agencies, local communities, and stakeholders, Bajhang district can work towards reducing the impact of earthquakes and enhancing disaster resilience.

4.9.3. Discussion on Effectiveness of DRR Response

The significant impact of earthquakes on disaster awareness and preparedness in Nepal. Following earthquakes, there was a notable rise in awareness among the respondents, with 85 out of 90 individuals reporting increased awareness, while 5 individuals indicated no change. This surge in awareness post-earthquake is a common trend as people become more conscious of risks and safety measures needed for future disasters. However, despite heightened awareness, there may be challenges in ensuring full compliance with earthquake safety guidelines. Additionally, the inability of the Municipality to establish a disaster risk reduction plan underscores the importance of proactive disaster preparedness measures to effectively respond to and mitigate the impact of earthquakes. Though, Nepal federal government had formulated the DRRM act, rules and framework for cope with the disaster situation. The data suggests that ongoing community education efforts and awareness programs play a crucial role in enhancing earthquake awareness and preparedness, emphasizing the need for continuous education and proactive planning to build resilience in the face of disasters.

The role of security forces in the response and relief phase of the Bajhang earthquake in 2023 was crucial in providing immediate assistance and ensuring the safety of affected communities. The Nepal Army, Nepal Police, and Armed Police Force played a significant part in the overall earthquake response efforts. Their efforts in search and rescue, damage assessment, security provision, coordination, and relief distribution were crucial in mitigating the immediate impact of the disaster and ensuring the well-being of affected communities.

Development agencies like UNDP and Save the Children played a crucial role providing immediate relief, supporting reconstruction efforts, and engaging in long-term recovery initiatives. They collaborated closely with governmental bodies and local authorities to ensure coordinated efforts in providing assistance to the affected communities. Their multi-sectoral approach, including shelter, water, sanitation, education, protection, and mental health support, was essential in addressing the diverse needs of the affected communities and promoting resilience in the face of natural disaster

Moreover, the Chief District Officer (CDO) mentioned providing financial assistance through recommendation letters from local authorities. While this approach may facilitate financial support, the effectiveness and reach of this assistance method need to be critically evaluated to ensure that it adequately addresses the needs of earthquake victims in Bajhang district. The NDRRA had released the Rs. 250 million for disaster victim in Bajhang district

The immediate community response played a vital role in saving lives and providing initial assistance to neighbors came together, regardless of their socio-economic status or background, to support one another in the face of the disaster. This community-driven approach to disaster response the resilience and solidarity of the people in Bajhang. By relying on each other and mobilizing local resources, the community was able to initiate rescue operations and provide aid before external assistance arrived. The timely community response also underscores the importance of fostering strong social networks and community engagement in disaster preparedness. The government should enhance the capacity of community because they are the first responder while disaster would happen in future.

CHAPTER V

SUMMARY AND CONCLUSIONS

5.1. Summary

The research highlighted that a number of important details about the earthquake in Bajhang's catastrophe risk reduction. The respondents were not aware of the laws and guidelines pertaining to disasters, nor were they involved in any awareness campaigns before to the earthquake. This points to a possible weakness in the area's disaster preparedness measures and a lower degree of readiness among the populace. After the earthquake, there appears to have been some improvement in raising awareness levels, as people actively sought out information and realized how important disaster risk reduction was. There were notable psychological effects from the earthquake, as indicated by the numerous reports of mental anguish, sleep disturbances, and worries for vulnerable populations like the elderly, children, and pregnant women.

The significant impact of the earthquake on the affected areas, particularly Jay Prithvi Municipality Thalara and Chabispathivara Village Municipality. The earthquake resulted in loss of life, injuries, and extensive damage to residential buildings and government offices. The lack of earthquake-resistant buildings and building code systems in these areas further increased the vulnerability of structures and put the residents at higher risk during seismic events. The use of mud/clay as a building material in Thalara and Chabispathivara Village Municipality proved to be particularly susceptible to damage, with a large number of houses collapsing during the earthquake. In contrast, houses constructed with concrete in Jayaprithivi Municipality exhibited better earthquake resistance, with cracks but remained intact.

On October 3, a string of earthquakes with at least 12 shocks of 5.0 to 6.3 Mw in 15 hours struck far western Nepal. Within a week, there were approximately a thousand aftershocks of magnitude less than 4.0Mw in seven districts: Bajhang, Bajura, Baitaidi, Dadeldhura, Achham, Darchula, and Doti. Of these, Bajhang saw the greatest number of aftershocks. A landslide from the earthquake in Bajhang injured 25 persons and

claimed one life. The majority of the buildings damaged by the earthquake were individual homes.

The majority of the damage was incurred by 2906 fully damaged dwellings and 6140 partially damaged houses in Bajhang. In Bajhang, 123 government structures—mostly schools were totally destroyed, and Another 152 government buildings, of which 152 are located in Bajhang, have partial damage. Lifelines including power, water, telecommunication, and other services were not severely disrupted, despite the fact that landslides temporarily closed several portions of roadways. There were reports of a few dead and a few damaged livestock. The majority of people, including schools, were able to save themselves and get pupils to safety. Due to the landslide, it is believed that two schoolchildren were seriously hurt when they returned home. Thankfully, there have been fewer human casualties than there could have been.

For individuals whose homes were completely destroyed, there is an immediate need for temporary housing. Humanitarian organizations have provided temporary shelter kits that include additional necessities like food in order to meet demands. But the kits that were provided were insufficient for those who were affected. It is imperative that the destroyed buildings be rebuilt as soon as possible and finished before the next monsoon. Supports for rehabilitation could be coordinated with mason training for current construction workers and their families.

The study's short-term recommendation Support for keeping schools open is extremely important and necessary. Since the majority of the houses and buildings were damaged as a result of noticeably subpar construction, recovery support should be coordinated with reconstruction efforts. Training in safe house construction is also essential. From a management perspective, local governments ought to assume the lead, and in light of the lessons learned from this incident, the initial requirements assessment and damage assessment procedure ought to be examined and updated. Reevaluating their involvement might also be an option for humanitarian organizations, as it would guarantee that the government stays true to its main duty.

For long term, local level should develop and enforcing rules and regulations at the local level for ensuring compliance with disaster mitigation measures. Local authorities

should collaborate with stakeholders to establish regulations governing building codes, emergency response protocols, and community safety standards, thereby enhancing resilience against natural disasters. Incorporating earthquake-related lessons into school curricula is paramount for educating the younger generation on disaster preparedness. By introducing topics such as earthquake safety, response procedures, and risk mitigation strategies, students can develop a comprehensive understanding of the threats posed by earthquakes and learn how to protect themselves and others during such events. The establishment of an APF training college in Sudur Pachasim Province is a strategic move to enhance the region's capacity in disaster response and security management.

5.2. Conclusions

The research revealed objectives of regarding DRR of the earthquake in Jayprithivi Municipality, Thalara and Chabispathivara rural Municipality in Bajhang district. To assess the disaster risk reduction initiatives implemented in Bajhang before the earthquake in 2023, the research should examine activities undertaken by local authorities and stakeholders to mitigate earthquake risks. This may include evaluating the awareness campaigns, training sessions, and community engagement efforts aimed at promoting disaster preparedness. The study should also assess the implementation of building codes, the use of earthquake-resistant construction materials, and the retrofitting of existing structures. To analyze the causes of earthquake damage in the Bajhang Earthquake 2023, the research should investigate the factors that contributed to the extensive damage to residential buildings, government offices, and school infrastructure. This may include examining the use of vulnerable building materials, such as mud/clay, the lack of earthquake-resistant design principles, and the absence of effective building codes. The study should also consider the geographical conditions, poor infrastructure, and socio-economic factors that may have exacerbated the vulnerability of the affected areas. To assess the effectiveness of DRR and response during the 2023 Bajhang earthquake, the research should evaluate the preparedness and response measures taken by local authorities, emergency services, and humanitarian organizations. To analyze the timeliness and adequacy of search and rescue operations,

the provision of emergency shelter and relief supplies, and the coordination among various stakeholders.

The aftermath of the 2023 Bajhang earthquake revealed a series of critical findings that shed light on the challenges faced by the local population and the shortcomings in disaster risk reduction efforts. One significant issue identified was the **lack of awareness** regarding disaster rules and regulations among the community, indicating a notable gap in preparedness. This lack of awareness was compounded by the failure to adhere to **building codes**, with many structures constructed using vulnerable materials like mud and stone, leading to widespread destruction compared to more resilient concrete buildings. Moreover, the absence of **local-level disaster risk reduction laws** further exacerbated the vulnerability of the area. Despite the provision of temporary shelters by the government, many individuals opted to remain in **partially damaged houses**, while others repurposed the shelters for livestock, highlighting the dire living conditions post-earthquake. The impact of the disaster was disproportionately felt in **poverty-stricken areas**, underscoring the need for targeted support for vulnerable communities. Discontent arose from the government's failure to fulfill promises of financial aid, ranging from Rs 25,000 to 200,000, leaving many survivors dissatisfied and referring to the government as "disaster tourists."In the wake of the earthquake, local NGOs and stakeholders stepped in to provide **awareness programs** and mason training for retrofitting partially damaged houses, demonstrating a grassroots effort to enhance community resilience. Despite challenges such as shortages of essential supplies and limited open spaces in Jayaprithivi Municipality, the community expressed gratitude for the immediate assistance provided by neighbors during the crisis.The government's prioritization of the Jajarkot earthquake over the Bajhang earthquake, despite the latter's greater impact, underscored the need for a more equitable and comprehensive approach to disaster management. These findings emphasize the urgency of strengthening disaster preparedness, improving building standards, and ensuring effective response and recovery mechanisms to enhance resilience in earthquake-prone regions like Bajhang..

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APPENDIXES

Filed Questions

For The Thesis Paper: **Earthquake Risk Reduction and**

Management: A case study of 2023 Bajhang Earthquake, Nepal

Form Serial No: ……..

Date: ……. (DD/MM/YYYY)

Basic Information:

Name of Respondent: Ms./Mr…… (Optional)

Age: …….Yrs.

Sex:

☐Male

☐Female

☐Other

Education:

☐ Non-literate ☐ Literate Basic (1-8)

☐ Secondary (9 - Plus12)

☐ Diploma/Master

Occupation: ……

Ethnicity:

☐ Dalit ☐ Janajati

☐ Brahmin-Chhetri ☐ Thakuri

Questions for General Public & FDG

1. Do you know about the earthquake which was occurred in 2023 in Bajhang? बझाङमा २०८० सालमा गएको भूकम्पबारे के तपाईंलाई थाहा छ ?
2. Can you share you experience about during that earthquake? के तपाईं त्यस भूकम्पको बेलाको अनुभव सुनाउन सक्नुहुन्छ?
3. Before earthquake had you participate any awareness programme? भुकम्प अघि कुनै सचेतना मुलक कार्यक्रममा सहभागी हुनुभएको थियो । If participate, what types of awareness programme were .(यदि भाग लिएमा, कस्तो प्रकारको जागरूकता कार्यक्रम हरू थिए)
4. Have you got changed in your level of awareness in disaster risk reduction before and after earthquake? भूकम्पअघि र पछि विपद् जोखिम न्यूनीकरणमा तपाइका चेतनाको स्तरमा केहि परिवर्तन आएको छ ?
5. Before earthquake do you had constructed earthquake resilience building house? भुकम्प भन्दा पहिले तपाईले भुकम्प प्रतिरोधी भवन निर्माण गर्नु भएको थियो ?
6. After earthquake do you have constructed earthquake resilience building house? भूकम्पपछि भूकम्प प्रतिरोधी भवन निर्माण गर्नुभएको छ ?
7. Which material you used in your house, concrete or mud? तपाईले आफ्नो घरमा कंक्रिट वा माटोमा कुन-कुन सामग्री प्रयोग गर्नुभएक छ ?
8. After the earthquake, do you have face problem? If yes what types of problem? भूकम्पपछि के तपाईंलाई समस्या भएको छ? यदि हो भने तपाईंले कस्ता समस्याहरूको सामना गर्नुहुन्छ?
9. What types of lose you faced during the earthquake? भूकम्पको समयमा तपाईंले कस्तो प्रकारको नोक्सानी बेहोर्नुपऱ्यो?
10. Are there any loss and damage associated with the earthquake-induced landslide, fire etc? भूकम्पले निम्त्याएको पहिरो, आगलागी आदिबाट कुनै क्षति भएको छ कि छैन ?
11. In your opinion what is the reason behind the loss and damage of prosperity after earthquake? भूकम्पपछि समृद्धिमा भएको क्षतिको कारण के हो ?

12. After the earthquake, who were the first responders, security force, local people or others? भूकम्पपछि सबैभन्दा पहिले उद्धार गर्ने हरू, सुरक्षाकर्मीहरू, स्थानीय मानिसहरू वा अरू को थिए?
13. Who you think are the most supportive/cooperative in the aftermath of the earthquake? भूकम्पपछिको अवस्थामा सबैभन्दा बढी सहयोगी/सहयोगी को हुनुहुन्छ जस्तो लाग्छ ?

14. Do you know what types of earthquake resilient new technology introduced by the government after earthquake? के तपाईंलाई थाहा छ, सरकारले कस्तो प्रकारको भूकम्प प्रतिरोधी नयाँ प्रविधि भित्र्याएको छ ?
15. After earthquake, have you received any relief fund from government or NGO/INGOs? के तपाईंले सरकार वा गैरसरकारी संस्था/आइएनजिओहरूबाट कुनै राहत कोष प्राप्त गर्नुभएको छ?
16. How did the level of preparedness among the local population impact the ability to mitigate and respond to earthquake damage in Bajhang? बझाङमा भूकम्पबाट भएको क्षतिको न्यूनीकरण र प्रतिकार्य गर्ने क्षमतामा स्थानीय जनताको तयारीको स्तरले कस्तो प्रभाव पार्‍यो?
17. Do you know, what types of disaster related law in Nepal? के तपाईंलाई थाहा छ, नेपालमा विपद्सम्बन्धी कस्तो कानून छ ?
18. What were the coordination between security forces and other stakeholders during response period? प्रतिकार्य अवधिमा सुरक्षा निकाय र अन्य सरोकारवालाबीच कस्तो समन्वय भयो ?
19. After the earthquake, have you participated any earthquake related awareness programme? भूकम्पपछि भूकम्पसम्बन्धी कुनै सचेतना मूलक कार्यक्रममा सहभागी हुनुभएको छ ?
20. Have you reconstructed the damaged/destroyed house? If not, what are the reasons? के तपाईंले भत्किएको/भत्किएको घरको पुनर्निर्माण गर्नुभएको छ? यदि होइन भने, कारणहरू के हुन्?

21. Do you have applied coding system in your house? के तपाईको घरमा कोडिङ प्रणाली लागू गरिएको छ?
22. After the earthquake how much you aware about preparedness to cope with it? भूकम्पपछि यसको सामना गर्ने पूर्वतयारीबारे तपाईं कतिको सजग हुनुहुन्छ?
23. In your opinion, what types of initiative should take by the government for reduce lose and damage in future? भविष्यमा हुने नोक्सानी कम गर्न सरकारले कस्तो प्रकारको पहल कदमी चाल्नुपर्छ?
24. There may have future earthquakes. What do you think of that you need to do to protect life and property from earthquakes? भविष्यमा भूकम्प आउन सक्छ। भूकम्पबाट जनधनको रक्षा गर्न तपाईंले के गर्नुपर्छ जस्तो तपाईंलाई लाग्छ?

APPENDIX “B”

Name list of Injured People in 2023 Bajhang Earthquake

S.N.	Name	Age	Address
1	Pramila Joshi	14	Ja.Na.Pa -11
2	Sabina Joshi	7	Ja.Na.Pa -11
3	Nitik Bohora	4	Ja. Na. Pa-. 07
4	Rima Pariyar	23	Ja. Na.Pa.-10
5	Uttam Swarnakar		Ja. Na.Pa.10
6	Dirgha Dhami	20	-
7	Godawari Joshi	28	Bu. Na. Pa-04
8	Devraj Joshi	45	Bu. Na. Pa.-04
9	Anil syada	13	Bitthadachir Ga.Pa.06
10	Abhisek B.K.	21	Bitthadachir Ga.Pa. 09
11	Nisha B.K.	15	Kedarsyau Ga.Pa.04
12	Bela Devi Chalaune	50	Chhabisapathibhara Ga.Pa. 06
13	Sangita Chalaune	22	Chhabisapathibhara Ga.Pa. 06
14	Sunita Rokaya	18	Khaptadachhanna Ga.Pa. 05
15	Yaishu Sarki	15	Masta Ga.Pa. 03
16	Sabita Rokaya	13	Masta Ga.Pa. 01
17	Shanty Devi Thapa	36	Masta Ga.Pa. 01
18	Kamal Kadal	18	Talakot Ga. Pa. 03
19	Ausu Ku. Sarki	75	Masta Ga.Pa. 03
20	Suku Bahadur Pharada	86	Masta Ga.Pa. 04
21	Bhirikuti Singh	43	Chhabisapathibhara Ga.Pa. 06

APPENDIX "C"

DDMC Meeting Decision

निर्णयहरु

निर्णय नं.१

विगतमा जिल्ला विपद् व्यवस्थापन समितिको बैठकले गरेका निर्णयहरुको विश्लेषण एवं समिक्षा गरियो ।

निर्णय नं.२

मिति २०८० असोज १६ गते दिउँसो २:४१ र ३:०६ बजेको समयमा यस जिल्लामा आएको भूकम्पबाट प्रभावितहरुको लागि जिल्ला विपद् व्यवस्थापन समितिमा प्राप्त देहायका राहत सामग्रीहरु पालिकास्तर देहाय बमोजिम वितरण गर्ने निर्णय गरियो । साथै भूकम्पको प्रभावलाई मध्यनजर गरी जिल्ला अस्पताल बझाङमा ३ वटा टेण्ट र ५ वटा मेट्रस, स्वास्थ्य कार्यालय बझाङमा २ वटा टेण्ट र २ वटा मेट्रेस र नेपाली सेनामा १ वटा टेण्ट वितरण गर्ने साथै सदरमुकाम चैनपुर बजारका अन्य प्रभावितहरुको लागि २० थान त्रिपाल र पत्रकार महासंघ बझाङमा १ वटा टेण्ट र २ वटा सोलार बत्ती वितरण गर्ने निर्णय गरियो ।

निर्णय नं.३

निर्णय नं.१ बमोजिमका राहत सामग्रीहरु जिल्लास्थित सबै पालिकाहरुले सम्बन्धित पिडितहरुलाई वितरण गरी सो को भरपाई ५(पाँच) दिन भित्र जिल्ला विपद् व्यवस्थापन समितिमा उपलब्ध गराउने निर्णय गरियो ।

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
त्रिपाल	६० थान	६० थान	१८ थान	४८ थान	२८ थान	४८ थान	५३ थान	४८ थान	५३ थान	६८ थान	३८ थान	३८ थान
टेण्ट	५ थान	५ थान	५ थान	५ थान	५ थान	५ थान	५ थान	५ थान	५ थान	५ थान	५ थान	५ थान
कम्बल	१२ थान	१२ थान	१२ थान	१२ थान	१२ थान	१२ थान	१२ थान	१२ थान	१२ थान	१२ थान	१२ थान	१२ थान
म्याट्रेस	८ थान	८ थान	८ थान	८ थान	८ थान	८ थान	८ थान	८ थान	८ थान	८ थान	८ थान	८ थान
चाउचाउ	२ कार्टुन	२ कार्टुन	२ कार्टुन	२ कार्टुन	२ कार्टुन	२ कार्टुन	२ कार्टुन	२ कार्टुन	२ कार्टुन	२ कार्टुन	२ कार्टुन	२ कार्टुन
कि-कर्भ	जिल्ला अस्पताल बझाङ १ बण्डल											
NFRI	जिल्लास्थित प्रत्येक वडामा १/१ थान											
चेपिलो बिस्कुट	७ कार्टुन	७ कार्टुन	७ कार्टुन	७ कार्टुन	७ कार्टुन	७ कार्टुन	७ कार्टुन	७ कार्टुन	७ कार्टुन	७ कार्टुन	७ कार्टुन	७ कार्टुन
पानी खाने बोतल	जिल्लास्थित प्रत्येक वडामा १/१ थान											
टर्च	जिल्लास्थित प्रत्येक वडामा १/१ थान											
थाली	जिल्लास्थित प्रत्येक वडामा १/१ थान											
गिलास	जिल्लास्थित प्रत्येक वडामा १/१ थान											
कचौरा	जिल्लास्थित प्रत्येक वडामा १/१ थान											
सिरानी	जिल्लास्थित प्रत्येक वडामा १/१ थान											
बाल्टिन	जिल्लास्थित प्रत्येक वडामा २/२ थान											
मग प्लास्टिक	जिल्लास्थित प्रत्येक वडामा १/१ थान											
डोरी	जिल्लास्थित प्रत्येक वडामा १/१ रोल											
मेट्रस	७ कार्टुन	७ कार्टुन	७ कार्टुन	७ कार्टुन	७ कार्टुन	७ कार्टुन	७ कार्टुन	७ कार्टुन	७ कार्टुन	७ कार्टुन	७ कार्टुन	७ कार्टुन
सोलार बत्ती	जिल्लास्थित प्रत्येक वडामा २/२ थान											
हाइजिन किट	जिल्लास्थित प्रत्येक वडामा ७/७ थान											
किशोरी किट	नगरपालिकामा २०/२० र गाउँपालिकामा १०/१०											

Photographs

Thalara rural Municipality- 5

Thalara rural Municipality- 7

Jayprtihivi Municipality-5

Jayprithivi Municipality-6,

APF,Nepal reside in this house

Balbikash School, Golae, Municipality after Earthquake

Balbikash SChii, Golae Municipality – 3 Now

Landslide JANAPA- 5

Landslide JANAP- 7

Death body rescue by APF,Nepal

Due to Land slide after Earthquake


Researcher with Respondent's


APR, Nepal in Rescue Operations

Temporary Shelter