COPING WITH THE FLOOD IMPACTS BY LOCALS OF RAJAPUR, BARDIYA

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Introduction

- Coping refers to the actions and strategies that individuals, communities, and societies employ to manage and adapt to stressors and challenges (Lazarus & Folkman, 1984).
- According to the WMO floods are the most common natural disaster in the world, affecting an average of around 120 million people annually (WMO, 2019).
- Climate change is increasing the frequency of river floods as well as drought (IPCC,2021).
- Nepal is considered one of the global hot spots for climatic disasters. In the top twenty poorest countries, Nepal ranks fourth and 30th positions in terms of climate change impacts and flood risk impact respectively (Tiwari, 2016)

Objectives

- To explore the effects of flood on occupation of local population.
- To investigate the adaptation strategies locals have implemented in response to impacts of floods in their occupations.
- To evaluate the impact of these adaptation measures on the socio-economic status of affected families.

Method and Methodology

Study Area

Province: Lumbini
District : Bardiya
Municipality : Rajapur
Area: 2025 km^2
Latitude : 28°21'25.16" N to 28°29'43" N
Longitude: 81°03'25.63" E

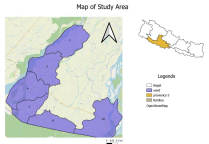

Figure: Map of Rajapur Municipality

Result

Impact of Flood on Occupation

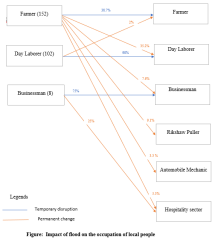

Figure: Impact of flood on the occupation of local people

Adaptation Strategies

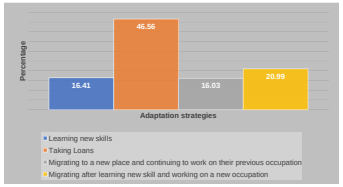

Fig: Adaptation strategies applied by locals in response to the impact of the flood on their occupation

Socioeconomic Impact of adaptation strategies

Impact of Adaptation Strategies on the Income of flood-affected families

Descriptive Statistics

Adaptation Strategies	Loans	Learning New Skills	Migration after learning new skills	Migration without learning new skills
Number of people	122	42	55	42
Mean	1.79	4.36	3.96	3.63
Median	2.00	4.00	4.00	4.00
Mode	2	4	4	4
Std. Deviation	0.658	0.485	0.808	1.234

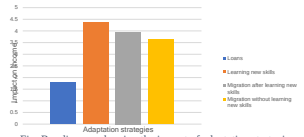

Fig: Bar diagram showing the impact of adaptation strategies on the Income of flood-affected families

Impact of Adaptation Strategies on living expenses of flood-affected families

Descriptive Statistics

Adaptation Strategies	Loans	Learning New Skills	Migration after learning new skills	Migration without learning new skills
Number of people	122	42	55	42
Mean	2.69	4.02	4.04	3.78
Median	4.00	4.00	4.00	4.00
Mode	2	4	4	4
Std. Deviation	0.657	0.269	0.334	0.613

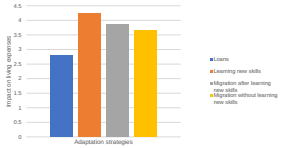

Fig: Bar diagram showing the impact of adaptation strategies on living expenses of flood-affected families

Impact of Adaptation Strategies on Children's Education

Descriptive Statistics

Adaptation Strategies	Loans	Learning New Skills	Migration after learning new skills	Migration without learning new skills
Number of people	122	42	55	42
Mean	2.81	4.24	3.85	3.66
Median	3.00	4.00	4.00	4.00
Mode	3	4	4	4
Std. Deviation	0.753	.431	.563	.728

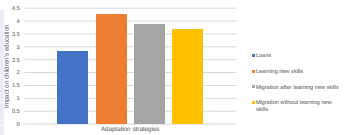

Fig: Bar diagram showing the impact of adaptation strategies on children's education

Discussion

- Farmers experienced temporary occupation disruption (38.7%). Limited alternatives for farmers shifted to day laborers (35.2%).
- Learning new skills, loans, and migration are key adaptation strategies.
- Learning new skills was associated with higher mean income and loans were associated with significantly lower mean income.

Recommendation

- Provide skill development programs for farmers and vulnerable groups.
- Offer immediate financial resources for recovery and livelihood rebuilding.
- Conduct in-depth studies to determine the long-term impact of adaptation strategies on income and living expenses.

Conclusion

- Farmers faced vulnerability to flood-related disruptions, with changes in their occupation while other occupations showed resilience.
- Diverse adaptive strategies were employed, including learning new skills, taking loans, and migration.
- Learning new skills provided employment diversification and reduced vulnerability.

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Thesis for the Degree of Master of Science in Environmental Science and Management

COPING WITH THE FLOOD IMPACTS BY LOCALS OF RAJAPUR, BARDIYA, NEPAL

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June, 2023

Thesis for the Degree of Master of Science in Environmental Science and Management

COPING WITH THE FLOOD IMPACTS BY LOCALS OF RAJAPUR, BARDIYA, NEPAL

Supervised by Asso. Prof. Ajay Bhakta Mathema

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Environmental Science and Management

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Pokhara University, Nepal

June, 2023

Declaration

I, Rabindra Prasad Ojha, hereby declare that this Project paper entitled, **COPING WITH THE FLOOD IMPACTS BY LOCALS OF RAJAPUR, BARDIYA** is my original work and has not been submitted anywhere else for any academic award. All literature, data, or works done by others and cited within this report has been given due acknowledgment and listed in the reference section.

……

Rabindra Prasad Ojha

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June 2023

Recommendation

The thesis attached hereto entitled "**COPING WITH THE FLOOD IMPACTS BY LOCALS OF RAJAPUR, BARDIYA**" was prepared and submitted by Rabindra Prasad Ojha in partial fulfillment of the requirement for the Degree of Master of Environmental Management under my supervision and is hereby accepted.

…….
Asso. Prof. Ajay Bhakta Mathema
School of Environmental Science and Management (SchEMS)
June 2023

Certificate

This is to certify that the thesis entitled **"COPING WITH THE FLOOD IMPACTS BY LOCALS OF RAJAPUR, BARDIYA"** submitted by Rabindra Prasad Ojha is examined and accepted as partial fulfillment for the degree of Master of Science in Environmental Science and Management. The thesis in part or full is the property of the School of Environmental Science and Management and should not be used to award any other academic degree in any other institution.

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External Examiner

Asso. Prof. Ajay Bhakta Mathema …..…..…… Date
Supervisor

Mr. Praveen Kumar Regmi ……. Date
M.Sc. Coordinator

Letter of Approval

This dissertation paper submitted by Mr. Rabindra Prasad Ojha entitled **"COPING WITH THE FLOOD IMPACTS BY LOCALS OF RAJAPUR, BARDIYA"** has been accepted for the partial fulfillment of Master of Science in Environmental Management from Pokhara University.

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Principal
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Abstract

The Rajapur Municipality is one of the major flood-prone sites of Nepal and communities are more vulnerable because of seasonal and unseasonal floods in rivers like Karnali and Geruwa. These floods have caused significant damage to property and infrastructure, and have displaced thousands of people. This study was aimed at investigating the impacts of floods on occupation, adaptation strategies, and socioeconomic implications of adaptation strategies in Rajapur, Bardiya. The study used a mixed approach, both qualitative and quantitative to provide a comprehensive understanding of the multifaceted relationship between floods and local communities. Data were collected from six flood-prone wards encompassing 262 households. According to the findings, farmers, a vulnerable group, were significantly affected by floods, which led to both temporary and long-term changes in their occupations. The limited options available, such as switching to day laborer jobs, highlight farmers' difficulties in maintaining their livelihoods. On the other hand, occupations such as businessmen displayed higher levels of resilience, with the majority continuing their work despite temporary disruptions. The research highlights the diverse adaptive strategies employed by individuals in response to flood impacts, with learning new skills emerging as a crucial strategy. This adaptation strategy enables people to diversify their work options and lessen exposure to disruptions brought on by flooding. The report also highlights the important role that taking loans plays in helping flood-affected individuals recover financially. Migration also emerged as a prevalent adaptation approach, encompassing the continuation of previous occupations in new locations or the acquisition of new skills for different employment opportunities.

The thesis further explores the socioeconomic implications of various adaptation strategies employed by flood-affected families. Learning new skills emerged as an effective strategy, leading to increased income through expanded job opportunities. In contrast, reliance on loans resulted in lower income levels due to repayment obligations. The study examines the effect of adaptation techniques on living expenses, revealing that learning new skills and migrating after learning new skills are associated with higher expenses. In comparison, loan-dependent families prioritize essential needs, and day laborers face financial challenges. Moreover, the research uncovers the influence of adaptation strategies on educational outcomes. Learning new skills and migrating after learning new skills positively affect children's education, while loans have a slightly negative impact. The findings provide valuable insights into the complex dynamics between floods, occupation, adaptation strategies, and socioeconomic conditions. My findings suggest that there is a need for more research on the long-term effects of adaptation strategies on flood-affected communities.

Keywords: floods, coping, occupation, adaptation strategies, socioeconomic implications.

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List of Abbreviations

DWIPD	Department of Water Induced Disaster Prevention
EM-DAT	Emergency Events Database
FDG	Focus Group Discussion
ICIMOD	International Centre for Integrated Mountain Development
ILO	International Labour Organization
INGOs	International non-governmental organizations
IPCC	Intergovermental Panel on Climate Change
LDCPR	Local Disaster and Climate Resilience Plan
MoFE	Ministry of Forest and Environment
MoHA	Ministry of Home Affairs
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNDP	United Nations Development Programme
UNISDR	United Nations International Strategy for Disaster Reduction
UNFCC	United Nations Framework Convention on Climate Change
UNU-EHS	United Nations University - Institute for Environment and Human Security
WMO	World Meteorological Organization

CHAPTER I:

INTRODUCTION

1.1: Background

Coping refers to the actions and strategies that individuals, communities, and societies employ to manage and adapt to stressors and challenges. This can include psychological, behavioral, and social mechanisms for adapting to adversity, such as seeking support from others, problem-solving, and emotion regulation. Coping is a complex and dynamic process that can change depending on the nature of the stressor, the individual's personal resources and strengths, and the availability of supportive resources in the environment (Lazarus & Folkman, 1984). The term coping strategy describes the approaches people employ to deal successfully with a crisis (Davis, 1996).

According to the WMO (2019) floods are the most common natural disaster in the world, affecting an average of around 120 million people annually. The effects of floods can be devastating, resulting in loss of life, damage to infrastructure and homes, displacement of populations, and disruption of economies. In addition to their immediate impacts, floods can also have long-term effects on communities, including loss of livelihoods and increased vulnerability to future disasters. Flooding can have a significant impact on the occupation and livelihoods of the local population, affecting their ability to earn a livelihood and support their families. In addition, floods can also have a negative impact on the socio-economic situation of affected families, by causing damage to property and infrastructure and disrupting economic activities.

Climate change is increasing the frequency of river floods as well as drought (IPCC, 2021). Nepal is considered one of the global hot spots for climatic disasters. In the top twenty poorest countries, Nepal ranks fourth and 30th positions in terms of climate change impacts and flood risk impact respectively (Tiwari, 2016). Nepal has also been subjected to several floods, many of which have resulted in significant loss of life as well as the economy. Nepal’s rugged topography, haphazard land use, melting of snow caps and outburst of the glacier lake, and concentrated monsoon rain are a few key causes of water-induced disaster (DWIDP, 2013). Flooding and extensive inundation are major issues in the Terai, as a result of river course changes, bank erosion, and erosion in river meanders also due to the suspended load carried by the rivers. Each year, they widen and slash their banks. (Manandhar et al., 2011). Climate change and variability have a greater impact on rain-fed agriculture and subsistence farmers. It has a direct impact on food production and livelihood. Terai has experienced the worst climate change in recent decades, with severe drought, extreme and repeated floods, landslides, and other natural disasters (UNU-EHS and CRED, 2019).

1.2: Problem statement

Floods are the most frequently occurring natural disaster, accounting for 43% of all natural disaster events (UNU-EHS and CRED, 2019). According to the World Meteorological Organization, floods are responsible for more deaths and economic losses than any other type of natural disaster. The World Health Organization estimates that floods annually affect around 250 million people globally and cause thousands of deaths (WHO, 2012). The Asia region is the most flood-affected, accounting for over 80% of global flood deaths and more than 70% of global flood-affected people (UNU-EHS and CRED,2019).

In the context of Nepal, floods can have a significant impact on the livelihoods and occupations of local communities. floods in Nepal can disrupt the agricultural sector, which is the main source of livelihood for most of the population. Floods can damage crops, irrigation systems, and other agricultural infrastructure, leading to reduced crop yields and income losses for farmers. Flood-affected communities often lack the necessary resources and information to recover and rebuild their livelihoods, which can lead to prolonged poverty and vulnerability (ILO, 2012). Local communities in Nepal are often ill-equipped to cope with the impacts of floods due to limited resources, lack of information and awareness, and inadequate government support. This results in a significant negative impact on the livelihoods and well-being, of affected communities, with many struggling to recover and rebuild in the aftermath of a flood event.

The Rajapur Municipality is one of the most flood-prone sites ad communities are more vulnerable because of seasonal floods in rivers like Karnali and Geruwa. Several reports showed that the monsoon floods in 2017 were so devastating that the Terai area was heavily affected. Bardiya district is ranked Nepal's 4th position in terms of damage and loss of life (LDCPR, 2021). This study aims to assess the impacts of flood on the occupations of the local population, how they are adapting to the impacts and the effect of the adaptation measures on their socioeconomic situation.

1.3: Research questions

1. How occupation of local population is affected due to flooding?
2. How locals are adapting to the impacts of floods on their occupation?
3. What are the impacts of adaptive measures on socio-economic condition of affected families?

1.4: Objectives

General objective

- To investigate the impacts of flood on occupation, adaptation strategies of local communities, and its socioeconomic implications in Rajapur, Bardiya.

Specific objectives

- To explore the effects of flood on occupation of local population.
- To investigate the adaptation strategies locals have implemented in response to impacts of floods in their occupations.
- To evaluate the impact of these adaptation measures on the socio-economic status of affected families.

1.5: Rationale of the study

Floods can have a wide range of impacts on individuals and communities, depending on the severity of the event, the resources available to them, and their ability to adapt. Some ways that people may adapt to the impacts of floods on their occupations include finding alternative sources of income, relocating to higher ground, or making changes to their homes or businesses to better withstand future flood events. It is important to note that the ability of individuals and communities to adapt to the impacts of floods can be influenced by factors such as their socioeconomic status, access to resources and support, and government policies.

The community of Rajapur Bardiya is one of the areas that are frequently affected by flooding, causing damage to the property and livelihoods of the local population. The occupation of the locals in rajapur is mainly agriculture-based, and flooding can severely impact their ability to earn a livelihood. Due to recurring flooding events in Rajapur, disasters affect human physical, economic, social, and psychological well-being every year (LDCPR, 2021). Erosion of agricultural land and fertile soil, deposition of sediments, and overuse of chemical fertilizers have already causing declining in crop production in the area. The embankment has been a huge relief to the residents of Rajapur, but it is not strong enough to withstand a significant flood. Which results in the breakage of the dam causing massive destruction (Poudel, 2022). Despite the frequency of flooding in the area, little is known about how it affects the occupation of locals in Rajapur, and how they adapt to the impact of the flood on their occupation. Furthermore, there is limited information on the effectiveness of the adaptation measures being used by the affected families in terms of their socioeconomic situation. Thus, it is important to conduct research to understand the impact of flooding on the occupation and livelihoods of the local population in Rajapur, how they

are adapting to the impacts and the effect of the adaptation measures on their socioeconomic situation.

1.6: Limitation

- The study focuses primarily on money-generating occupations such as farming, business, and day laborers.
- Lack of long-term perspective on the effects of adaptation strategies.
- Limited scope of socioeconomic implications.

CHAPTER II:

LITERATURE REVIEW

2.1: An overview of climate change

Climate change refers to the long-term shifts in average weather patterns that have come to define Earth's local and global climates. This phenomenon is driven by both natural and human-caused factors, including changes in the amount of greenhouse gases in the atmosphere, deforestation, and other land use changes. Climate change can result in rising temperatures, more frequent and intense extreme weather events, and shifts in precipitation patterns, which can impact ecosystems and human societies (IPCC, 2018). The Earth's climate has experienced unprecedented warming over the past few decades (IPCC, 2012). The average global surface temperature has risen by 0.85 °C during the period of 1880– 2012, and the last three decades (1983–2012) were the warmest 30 years over the last 1400 years in the northern hemisphere (IPCC, 2013). As per climate model results, the global surface temperature is expected to further rise by 1–4 °C on the average by the end of this century relative to the period of 1986–2005, strongly depending on the greenhouse gas emission pathways (IPCC, 2012). The changes in the climate systems have aggravated modifications in functioning of ecosystems (Schickhoff et al., 2016; Shrestha et al., 2012; Xu et al., 2009) and led to occurrence of many extreme events across the globe (IPCC, 2014; Vargas et al., 2017; Sorokin, 2017). The frequency of high temperature events, warm days, and nights has increased, while low temperature events, cold days, and nights have declined across the globe (IPCC, 2013). Extreme rainfall events (floods and droughts) have increased in many parts of the world (Goswami et al., 2006; IPCC, 2013, 2014a, b; Schickhoff et al., 2016), while the number of rainy days has declined (Rani and Sreekesh, 2017).

2.2: Climate change induced hazards

According to UN-ESCAP Report (2015), a total of 11,985 natural disaster events were reported in the world during 1970–2014, of which floods and storms share about 64% and represent sharp increasing numbers in recent decades. However, the magnitude of changes in climatic extremes is not uniform across the globe, wherein some vulnerable ecosystems such as high altitude (mountains), high latitude, coastal regions, and developing regions such as Asia have observed more visible changes (IPCC, 2014a, b; CRED-UNISDR, 2015; Shrestha et al., 2012; Xu et al., 2009). The climatic extremes have repeatedly resulted in major disasters including heavy losses of infrastructure, economy, natural environment, and human populations (IPCC, 2012), not only in the immediate areas but also affected downstream regions (Bisht et al., 2011; Evans and Clague, 1994; Mal and Singh, 2014). For instance, the Uttarakhand floods (2012, 2013), the Mumbai floods (2005), and the Kashmir floods (2014) in India, the heat waves of 2003 and 2006 in Europe, in

2017 in Delhi, the extreme winters of 2009–2010 in Mongolia, the European floods (2013), and many other such events caused unparalleled damage (IPCC, 2012). Additionally, the droughts, heat, and cold waves and other extreme events do not only affect the human population but also ecosystems which in turn may result in negative effects on people due to shrinking provisions of ecosystem services (UNISDR, 2009). These extreme events over the period of time have further exposed large populations to different levels of risks, especially in developing countries making them highly vulnerable to disasters (Singh, 2000, 2006; UNISDR, 2008). In some critical regions such as the Himalaya, hydroclimatic extreme events have been observed to increase over the past decades (Stäubli et al., 2017; Joshi and Kumar, 2006; Goswami et al., 2006) with often major consequences for the vulnerable population and local economy. According to the UN Global Assessment Report on Disaster Risk Reduction, more than 1.6 million people died due to different disasters worldwide during 1990–2013 (UNISDR, 2015a), with more than 95% of the deaths worldwide during 1970–2008 from natural disasters occurred in developing countries (IPCC, 2012). The economic losses from such disasters have been estimated to be about US$ 250 billion to US$ 300 billion/year since 1990s, and expected annual economic losses by 2030 are estimated at US$ 415 billion, of which US$ 314 billion will be only inbuilt environment alone (UNISDR ,2015a). Further, the mortality and loss of economies due to disasters are increasing in low-income countries (UNISDR, 2015a; UNESCAP, 2015). Therefore, in view of the fact that climate change and related extreme events will lead to increased future losses (IPCC, 2012; UNISDR, 2015a), it is imperative to combat climate-related disasters and reduce the inherent risks toward a safer world in a coordinated manner at international, regional, national, and local levels.

Natural disasters cause thousands of families to become homeless every year. Hill communities face the danger of landslides, which can block roads and transportation. Landslides and floods are especially problematic in the Eastern Terai, Western and mid-Western Terai, and Hilly districts. Earthquakes are also a significant threat, particularly in densely populated urban areas, as most of Nepal is in a high seismic risk zone. The UNDP's Bureau of Crisis Prevention and Recovery (2004) ranks Nepal as the 11th most at-risk country for earthquakes and the 13th most at-risk for floods.

2.2.1: Flood

Climate change has been one of the most critical concerns in recent decades. Researchers have claimed that global hydrological cycles are expected to accelerate by climate change. Because of increased precipitation and reduced evapotranspiration, river discharge will increase on a global scale, which indicates an increase in the frequency of floods in many regions of the globe. Risk of great floods increased during the 20th century (Hirabayashi et al., 2008). Climate change appears to be influencing both the monsoon and tropical cyclones, the two prime drivers of flood events in South Asia. Floods will be affected by changes in temperature and in rainfall. Rising temperatures will accelerate the rate of melting of snow and glacier ice, increasing seasonal peak flows of Himalayan headwaters. This in turn may lead to an increased frequency of flooding, particularly

along rivers whose channel capacity had been reduced by sedimentation.). In the longer term, however, reduced snow cover will result in reduced water flow to rivers. (Aggarwal et al., 2004)

As one of the most frequent natural hazards in the world, floods pose serious threats to humans and their environment (Marfai et al., 2008; Nicholls, 2004; Nicholls et al., 2008). Of the 2,654 hazard events worldwide noted by Sivakumar (2005) from 1993 to 2002, 1,060 (about 40 %) were flood hazards. Compared with other natural hazards, such as high winds, droughts, landslides, and forest fires, the occurrence of floods is more frequent. Because of their high frequency, magnitude, and intensity, damage associated with flooding is often high and its scale is increasing, in terms of both the number of people affected and the economic losses. As reported by (Jha et al.,2012), 178 million people were affected by floods in 2010 with total economic losses exceeding more than US$ 4 million. Flood risk for lowland communities might increase in the future in many parts of the world because of a large number of drivers, including climate change (increased precipitation, extreme runoff, sea level rise), land subsidence, land use change, population growth, and the increase in assets located in flood-prone regions (IPCC, 2012; Jongman et al., 2012; Hirabayashi et al., 2013).

The Emergency Event Database recorded a total of 432 catastrophic events that occurred in 2021, which is much greater than the 357 catastrophic incidents that occurred annually on average from 2001 to 2020. Floods predominated these events with 223 occurrences, up from an average of 163 occurrences each year between 2001 and 2020. During the monsoon season (June to September), India saw a series of catastrophic floods that claimed 1,282 lives. Similarly, the Henan Flood in China in July, which left 352 people dead, 14.5 million people homeless, and cost $16.5 billion, was particularly devastating. 260 people lost their lives in Afghanistan's Nuristan Floods in the same month. The Central European Floods and associated landslides in July were the second-most expensive disaster, costing the German economy 40 billion US dollars. (EM-DAT, 2021) In 2021 a total of 10,492 people were killed, 101.8 million people were harmed, and 252.1 billion dollars in economic losses were incurred. Asia was the continent that was hit the hardest, accounting for 40% of all disasters, 49% of all deaths, and 66% of all persons affected. While the number of deaths and people affected was lower than the 20-year average, disaster incidents and economic, losses increased in 2021. (CRED, 2021)

Floods are the most frequent and costly natural disasters worldwide. The WMO reports that between 1980 and 2018, floods affected over 4.3 billion people and caused over 1.3 million deaths. Floods also resulted in economic losses of over US$1.6 trillion during this period. The WMO states that climate change is exacerbating the frequency and severity of floods through sea level rise and increased precipitation. The organization also highlights that poor land-use planning and inadequate infrastructure are major contributors to flood risk. The WMO encourages the use of early warning systems, risk assessments, and preparedness measures to reduce the impacts of floods. They also promote sustainable land-use practices and the development of resilient infrastructure to make communities more resistant to floods. (WMO, 2016)

2.2.2 Overview of flood in Nepal

In Nepal, floods are a frequent occurrence, with over 6,000 rivers and rivulets spread throughout the country. The main rivers, Koshi, Narayani, Karnali, and Mahalaki, originate from the Himalayas, flow through the hills, and into the terai plains. During the monsoon season, which lasts from June to September, these rivers experience a rise in water levels, which causes damage to the surrounding flood plains. Districts such as Baglung, Banke, Rautahat, Bardiya, and Sindhuli are particularly vulnerable to flood damage. Floods in Nepal can be categorized into two types: riverine and flash floods (c, 2007). Many villages in the Terai area get flooded every year because of barrages and embankments built in India by interfering with natural drainage cause water logging. The embankments built long the Bagmati, Karnali and West Rapti rivers close to the border have constrained the flow of rivers and contributed to the inundation of about 27 border localities. (MoHA, 2009)

2.3: Impact of flood on livelihood

Hydro-meteorological hazards, such as droughts and floods, have already resulted in extensive harm, and the loss of livelihoods, lives, and property, but their intensity is predicted to rise in the coming years. Precipitation levels are predicted to rise by 15-20% by the middle of the century, which would aggravate the effects of water-related calamities. Because a sizable amount of Nepal's economy and employment depends on climate-sensitive activities, climatic changes have a direct impact on people's quality of life. According to the Ministry of Science, Technology, and the Environment (2014), 35 percent of the GDP is derived from agriculture and forestry, and any variations in the weather or the production cycle may jeopardize the livelihoods of millions of people (UNDRR, 2019). The Terai area is the most productive but the big challenge of the worst effects of climate change. The projected direct costs of climate change to sensitive industries (including agricultural and energy generation) are anticipated to reach as high as 3% of total GDP by 2050 (Ministry of Science, Technology, and Environment, 2014).

Floods can have a devastating effect on livelihoods, particularly for people living in poverty or in low-income communities. According to the United Nations Office for Disaster Risk Reduction (UNISDR, 2014), floods can cause significant damage to homes, infrastructure, and crops, leading to loss of income, food insecurity, and displacement. Floods can also have a long-term impact on livelihoods by disrupting education, health services, and access to markets. This can result in a loss of human capital and future earning potential. Additionally, floods can also lead to the spread of disease, which can further impact people's livelihoods and overall well-being. There are several strategies that can be used to reduce the impacts of floods on livelihoods. These include early warning systems, community-based flood risk management, and disaster risk reduction strategies

that take into account the specific needs and vulnerabilities of vulnerable communities (UNISDR, 2014).

The damaging impacts of floods disrupt the agriculture, infrastructure, employment, and food distribution systems, as well as other aspects of livelihood. People living in flood-prone areas have to live their whole lives struggling against floods, and the most interesting thing is that they depend both directly and indirectly on rivers and floods for their livelihood. Hence, the majority of the people are willing to live in this place despite floods. It is also a reality that this poor community cannot leave this flood-prone area. Therefore, this rural poor community lives with flood, face it with hunger and food crises, suffer a loss of income and occupation, and cope with the situation by bearing substantial debt with high-interest rates and a loss of productive assets. All of these interrelated factors and impacts act as a driving force towards their long-lasting poverty and vulnerabilities, which limit their ability to prepare, respond, and recover from subsequent floods, as well as any other disasters (Parvin et al., 2016).

Study shows that households depend heavily on natural resources for their livelihood and that those with low income suffer greater losses from floods and droughts than households with high income. On the other hand, flood impact is higher on households that depend heavily on natural resources for their livelihood, and have lower incomes. The study uses survey data to examine the relationship between disaster frequency and localized poverty, an issue rarely considered in past literature. We show that low-income households that depend fully on natural resources for their livelihood are exposed to more frequent disasters and are most vulnerable to financial losses incurred through floods and droughts. To combat the effects of disasters, the Sri Lankan government might encourage members of poor households to seek at least some income from non-agricultural endeavors (Kawasaki et al., 2018).

2.4: Adaptation strategies

The adoption of coping strategies reveals an important pattern in how different households respond to a flood with respect to factors such as education, flood characteristics, income, occupation, and riverbank erosion. A rising level of household income is accompanied by increased access to food and drinking water, leading to a greater ability to cope with a disaster without relying on inexpensive food items or selling productive or unproductive assets. Similarly, the higher the education level the greater the scope to capture flood-forecasting information that reduces vulnerability to a disaster and enhances a household's ability to cope with a disaster. Occupation also has a similar influence: service-sector households, for instance, have a more stable income than farmers or laborers and thus have a greater ability to procure food and capture flood-forecasting information (Paul et al., 2010).

A study highlighted the effects of floods on households, revealing that the most impacted households experienced substantial decreases in income and expenditure. To mitigate these losses, there was a notable increase in the likelihood of migration as a coping strategy. The study also emphasized the significance of remittances from established international migrants, which

provided considerable financial support to poorer households, accounting for approximately forty percent of the income decline from self-employment in farming activities and half of the decrease in food expenditure (Giannelli et al., 2022)

Analyses of coping strategies hint that remittances from migrant relatives are a more efficient coping strategy in case of an area-wide crisis. Seasonal labor migration often remains an effective strategy to gain access to money to buy food when local non-farm income opportunities have lost some effectiveness.The individual households encouraged their family members to migrate out in order to attract the remittances sent for family support by the workers in urban centers (Armah et al., 2010).

A study in Bangladesh reports that people in an area with low flooding and with better socioeconomic circumstances are more likely to cope with impacts compared to people in areas with high and sudden flooding. Similarly, households' ability to cope varies depending on people's socioeconomic conditions, such as education, income and occupation. Although floods in Bangladesh generate socioeconomic misery and cause damage to the environment, health, and infrastructure, people's indigenous coping strategies have helped them to reduce significantly their vulnerability. Such flood-mitigating strategies should be well recognized and emphasized further via proper disseminationa of information through an early-warning system and subsequently external assistance. (Jayant et al., 2010)

Households in Bannabari and Suvagacha district of Bangladesh employ many coping methods during a flood. Among households exposed to shocks, for example, borrowing money (mostly after a flood) (Del Ninno and Dorosh, 2003) and disposing of assets are considered very important initiatives. This study found that the most common assets sold in both villages to overcome difficult periods and manage crises are cattle, chicken and trees. In flood prone areas, people also pursue alternative occupations, such as fishing and operating boats during a flood, in addition to their normal livelihoods linked to agriculture. Moreover, migration is seen as an option when all other measures fail.

A study carried out by Nepal Red Cross Society examines the coping mechanisms used by households in Nepal to deal with floods. The study found that the most common coping mechanisms used by households were: Borrowing money: Households often borrowed money from friends, family, or microfinance institutions to cover the costs of food, shelter, and other necessities. Selling assets: Households often sold assets, such as livestock, jewelry, or furniture, to raise money. Seeking government assistance: Households often sought government assistance, such as food rations, cash grants, and loans.

The study also found that the use of coping mechanisms varied depending on the severity of the flood and the household's socioeconomic status. Households that were more severely affected by floods were more likely to use all three coping mechanisms. Households with higher

socioeconomic status were more likely to borrow money and seek government assistance, while households with lower socioeconomic status were more likely to sell assets (Nepal Red Cross Society., 2018).

CHAPTER III:

METHODOLOGY

3.1: Study area

Bardiya District is a part of Lumbini Province, is one of the 77 districts of Nepal. It covers 2025 sq km and lies west of Banke District, south of Surkhet District of Karnali Province, east of Kailali District of Sudurpashchim Province. Rajapur Municipality is one of the eight municipality located in Bardiya district of Lumbini state of South-Western Nepal. It is formed by merging 7 VDCs and consists of 10 wards.

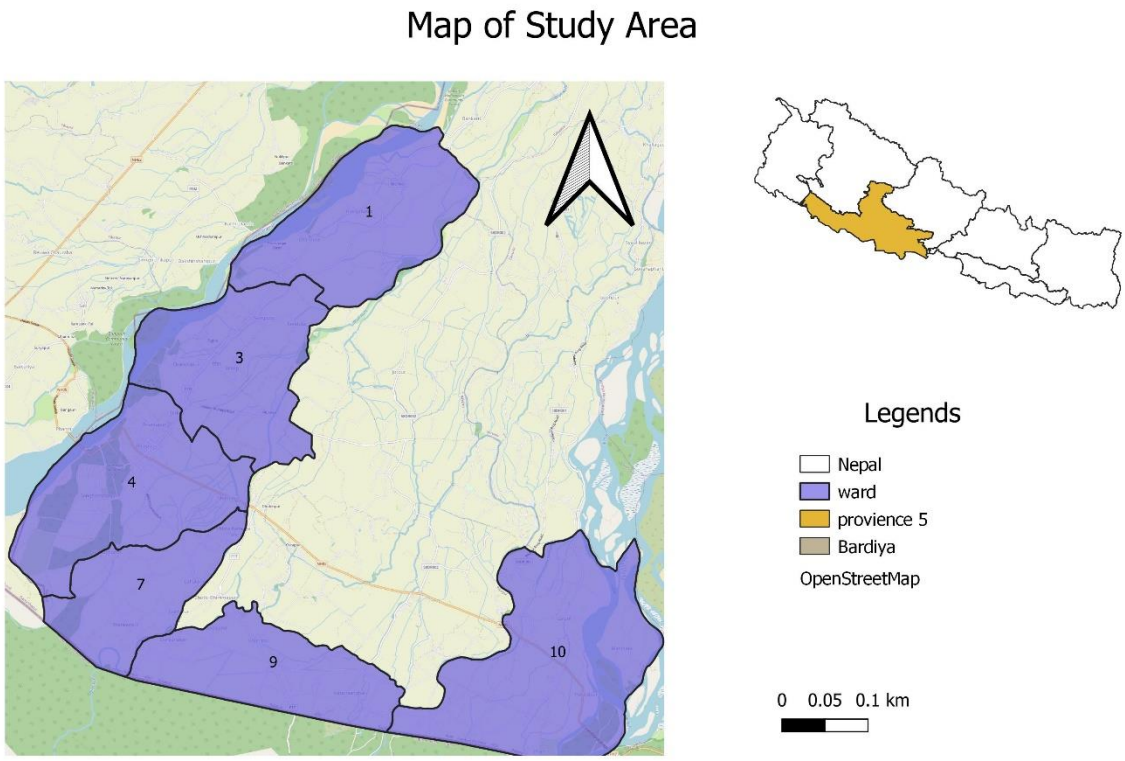
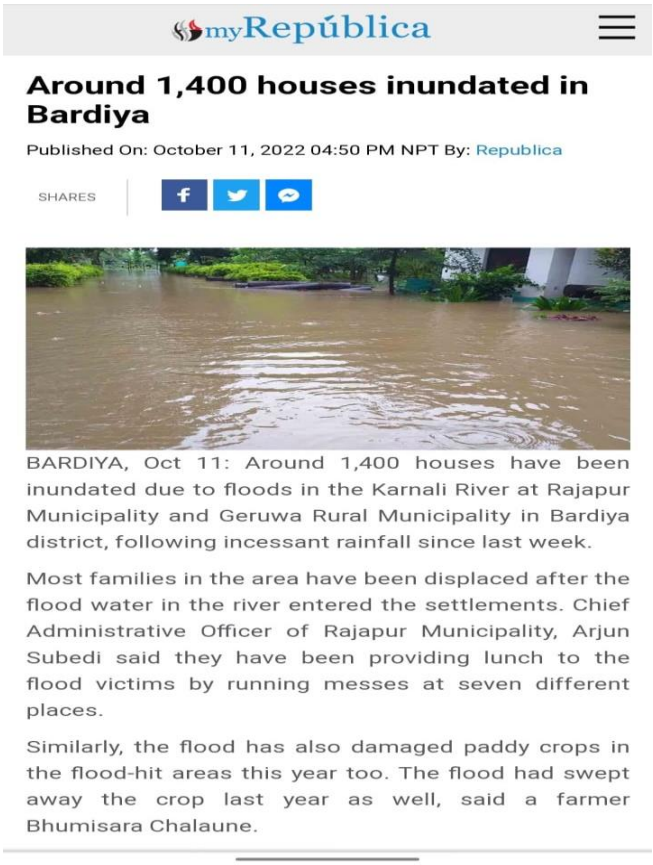


Figure 1 Map of Study Area

The idea behind selecting Rajapur, Bardiya for my study was due to the fact that this district has been affected by floods constantly. Bardiya district of Nepal is one of the most hazard affected districts of Nepal. Every year the districts suffer from intense flooding which disrupts lives of people, ruins agricultural lands and hundreds gets displaced. In the year 2022 Rajapur municipality has experienced major flooding, so my primary focus was to conduct my research on the basis of flooding that has occurred on October, 2022 and also on the basis of major recent floods.



myRepública

Around 1,400 houses inundated in Bardiya

Published On: October 11, 2022 04:50 PM NPT By: Republica

SHARES

BARDIYA, Oct 11: Around 1,400 houses have been inundated due to floods in the Karnali River at Rajapur Municipality and Geruwa Rural Municipality in Bardiya district, following incessant rainfall since last week.

Most families in the area have been displaced after the flood water in the river entered the settlements. Chief Administrative Officer of Rajapur Municipality, Arjun Subedi said they have been providing lunch to the flood victims by running messes at seven different places.

Similarly, the flood has also damaged paddy crops in the flood-hit areas this year too. The flood had swept away the crop last year as well, said a farmer Bhumisara Chalaune.

Fig: my Republica newspaper published on October 11,2022

3.2: Methodological Framework

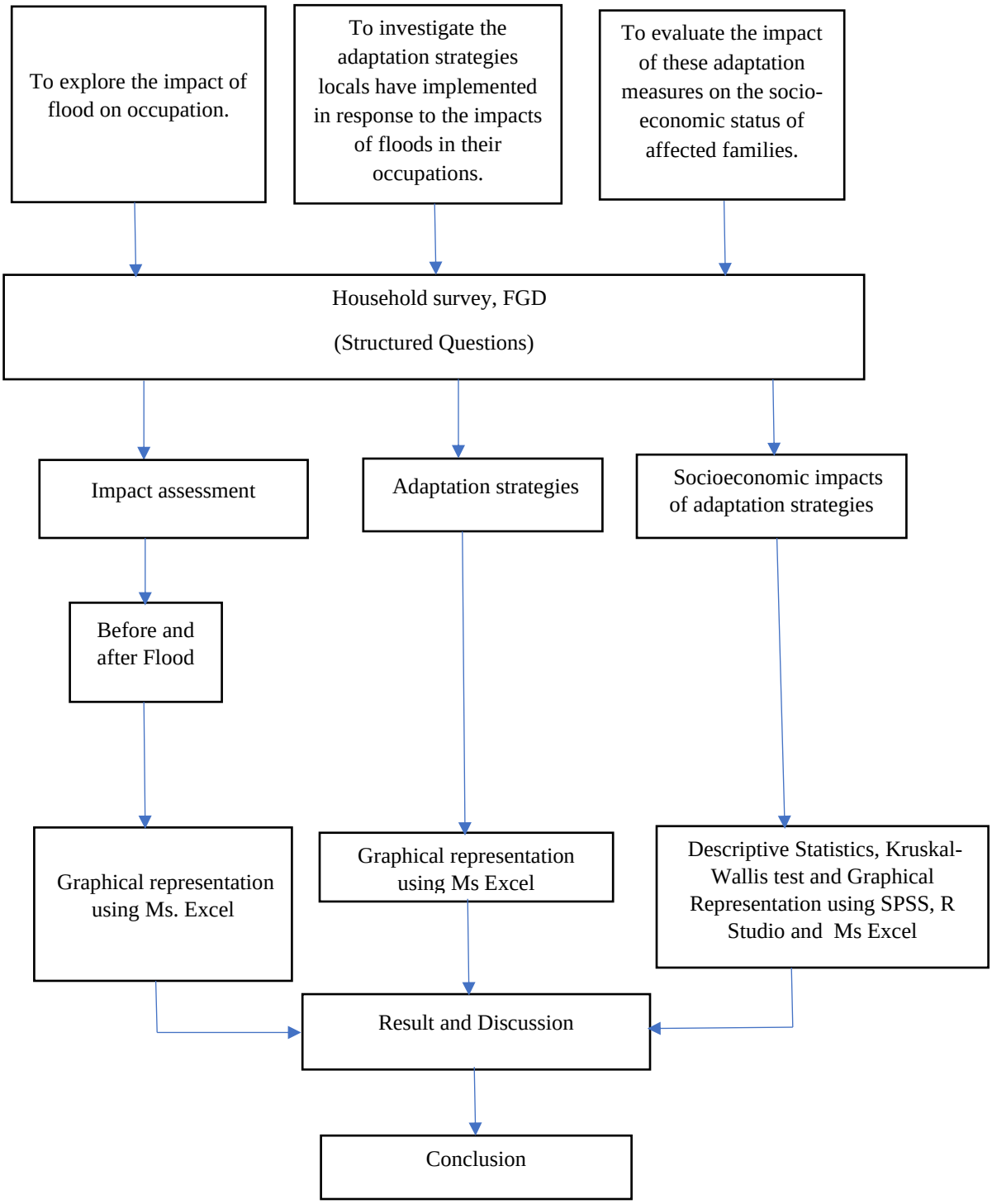


Figure 2 Methodological Framework

3.3: Objective wise research matrix

Table 3.1: Objective wise research matrix

Objectives	Data needed	Data Collection Method	Data Analysis Tools	Expected Outcome
To explore the impact on the occupation of local population by flooding.	• Data of Occupation status before and after flood	• Household survey • Focus Group Discussion	Ms Excel	• Impact on occupation due to flood.
To investigate the adaptation strategies locals have implemented in response to the impacts of floods in their occupations.	• Adaptation measures implemented in response to the impacts of floods on their occupations.	• Household survey • Focus Group Discussion	R studio, Ms Excel	• Adaptation measures implemented after the incident of flood.
To evaluate the impact of these adaptation measures on the socio-economic status of affected families.	• Data on income, living expenses, and education status of children.	• Household survey • Focus Group Discussion	R Studio, SPSS, Ms Excel	• Socioeconomic condition of families after implementation of adaptation measures.

3.4: Research method

3.4.1: Sampling technique and Data collection

Sample size was calculated using Cochran's formula,

$n_o = Z^2pq/e^2$

Where,

Z= statistical value corresponding to level of confidence required (1.96)

p= the (estimated) proportion of the population which has the attribute in question (0.95)

q= 1 – p (0.5)

e= the margin of error (5%)

Modification for the Cochran Formula for Sample Size Calculation in Smaller Populations n= [n0/(1+((n0-1)/N)].

Where,

n0= Cochran sample size

N= household number

n= sample size

According to LDCPR, 2021 report of Rajapur municipality there are mainly 6 wards that are prone to flooding. So these 6 wards (i.e 1,3,4,7,9, and 10) were selected for data collection. There are total 6549 households in selected wards. Using Cochran's formula sample size was 262 after applying 90% confidence limit. Sample size in each ward is calculated using population proportion of each ward.

3.4.2: Data collection

Data collection was carried out through a questionnaire-based household survey (HHS) and Focus Group Discussion (FGD) using Kobotoolbox. Structured questionnaire was prepared to collect data from sample households. Questionnaire had covered impacts of flood on occupation before and after flooding of October 2022 and previous floods. Adaptation measures of locals regarding their occupation due to flooding was studied. After knowing the complete scenario about adaptation strategies, impact of those strategies on socioeconomic status was evaluated. Both negative and positive impacts has been studied.

Data collection took place from June 5, 2023, to June 20, 2023, encompassing a total sampling duration of 114 hours. Additionally, three focus group discussions were conducted, involving village heads, women's groups, and farmers.

3.4.3: Data Analysis

Data on the effects of floods on occupation was gathered and visualized using Ms. Excel. Data on adaptation measures applied by locals was collected using questionnaire survey and data

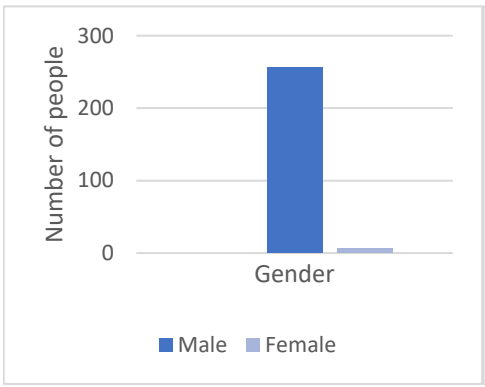
visualization was carried out through Ms excel. Following a thorough understanding of the situation surrounding adaption strategies, the effects of those strategies on socioeconomic status were assessed. Mean, median, mode and standard deviation were calculated using SPSS. Further analysis of impact of adaptation strategies on socioeconomic status was performed through Kruskal-Wallis Test using "stats" package in R Studio. Test is carried out to check if there is significant difference between impact of adaptation strategies on socioeconomic status.

CHAPTER IV:

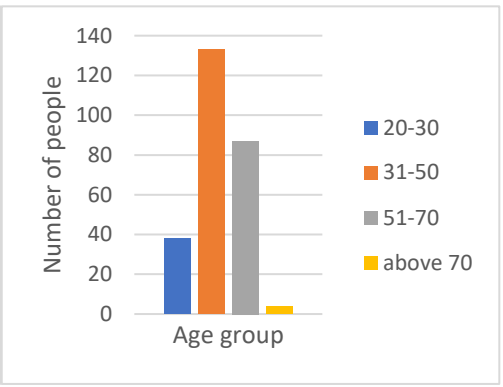
RESULTS

4.1 Demographic Profile of Economically Active Household Head

Gender



Age



Education Level

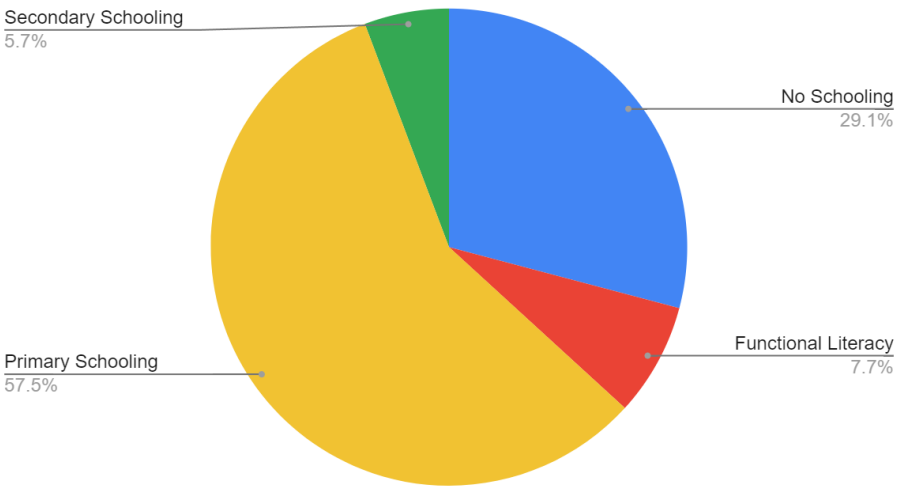


Figure 3 Demographic Profile of Economically Active Household Head

Almost all respondents were male. The main reason behind this could be, in the western parts of Nepal, women are primarily occupied with domestic tasks such as cooking, childcare, and livestock management, whereas men are more engaged in generating income.

Among the respondents ,15% are in the age group 20-30, 52.7% are in the age group 31-50, 34.5% are in the age group 51-70, and 1.6% are in the age group 70 and above.

The data shows that the majority of main breadwinners (57.5%) have completed primary schooling, while 29.1% have no schooling, 7.7% have functional literacy, and 5.7% have completed secondary schooling. It is concerning that a significant proportion of the main breadwinners have no formal education, which may limit their employment opportunities and income-generating potential.

4.2 Impact of Flood on Occupation

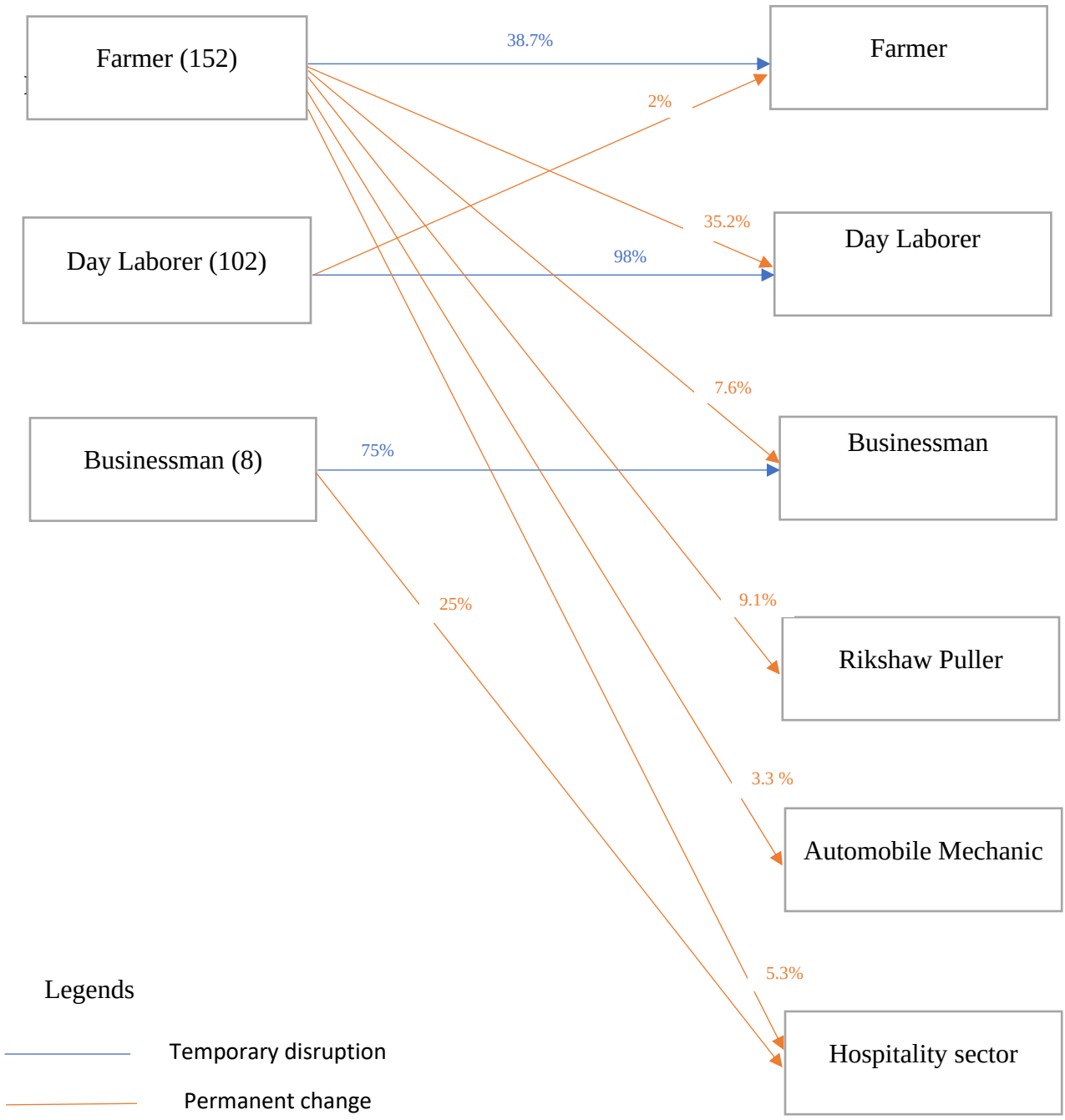


Figure 4 Impact of flood on the occupation of local people

The collected data provides insights into the impact of flood on the occupation of farmers, day laborers, and businessmen. Out of 152 farmers, 38.7% experienced a temporary disruption in their occupation due to the flood, while the rest have undergone permanent changes in their profession. Among those who have changed their occupation, 35.2% have shifted to day laborer, 7.6% have become businessmen, 9.1% have turned to rickshaw pulling, 3.3% have started working as automobile mechanics, and 5.3% have joined the hospitality sector. On the other hand, day laborers faced a relatively smaller impact, out of 102day laborers, only 2% changed their occupation and the rest faced temporary disruption in their profession during the flood. For businessmen, the majority (71.4%) continued to work despite the temporary disruption, while only 2 out of 8 (28.6%) changed their occupation to the hospitality sector.

4.3 Adaptation Strategies

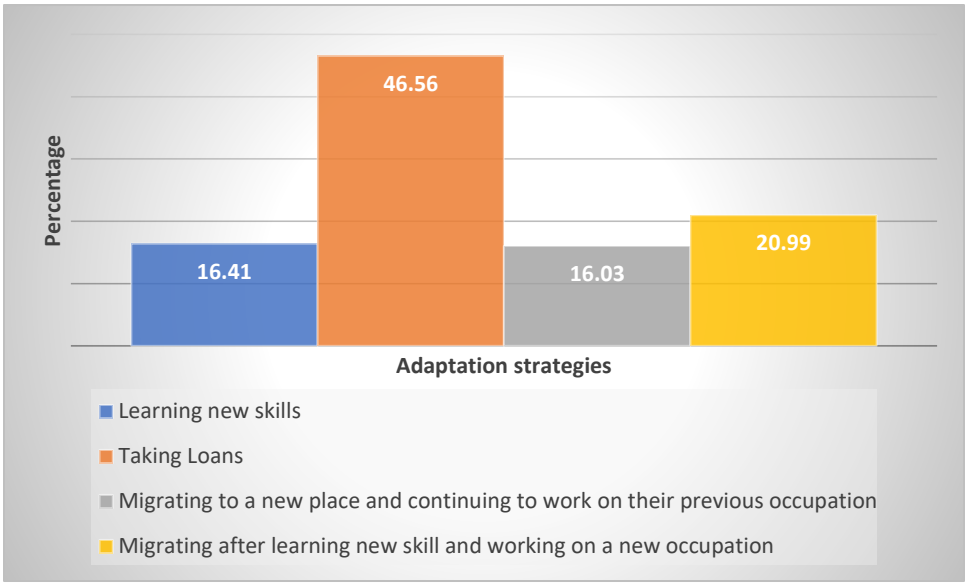


Figure 5 Adaptation Strategies

According to the data collected, people affected by floods adopted various adaptation strategies. Among them, the majority of the people 46.56% chose to take loans to cope with the situation. They have utilized the money to maintain their houses affected by the flood and to buy food items. Additionally, 16.41% people learned new skills and changed their occupations as a coping strategy. This indicates that people affected by floods are willing to adapt to the situation by exploring new options for their livelihood.

Furthermore, 37.02% people chose to migrate as a coping mechanism. Among them, 16.02% people migrated without learning new skills and continued to work in their previous occupations. On the other hand, 20.99% people migrated after learning new skills, such as cooking, waiter, rickshaw pulling, and automobile repairing. This highlights the importance of education and training to help individuals cope with flood-related disruptions in their occupations. Overall, the

data suggest that a combination of coping strategies, such as loans, learning new skills, and migration can help people adapt to the challenges posed by flood-related disruptions in their occupations.

4.4 Socioeconomic Impact of adaptation strategies

4.4.1 Impact of Adaptation Strategies on the income of flood-affected families

Table 4.4.1: Impact of Adaptation Strategies on the income of flood-affected families

Descriptive Statistics

Adaptation Strategies	Loans	Learning New Skills	Migration after learning new skills	Migration without learning new skills
Number of people	122	42	55	42
Mean	1.79	4.36	3.96	3.63
Median	2.00	4.00	4.00	4.00
Mode	2	4	4	4
Std. Deviation	0.658	0.485	0.808	1.234

Table 4.4.1: Impact of Adaptation Strategies on the income of flood-affected families

Legends

1= Significant Decrease, 2= Small decrease, 3= Neutral, 4= Small increase,

5= Significant increase

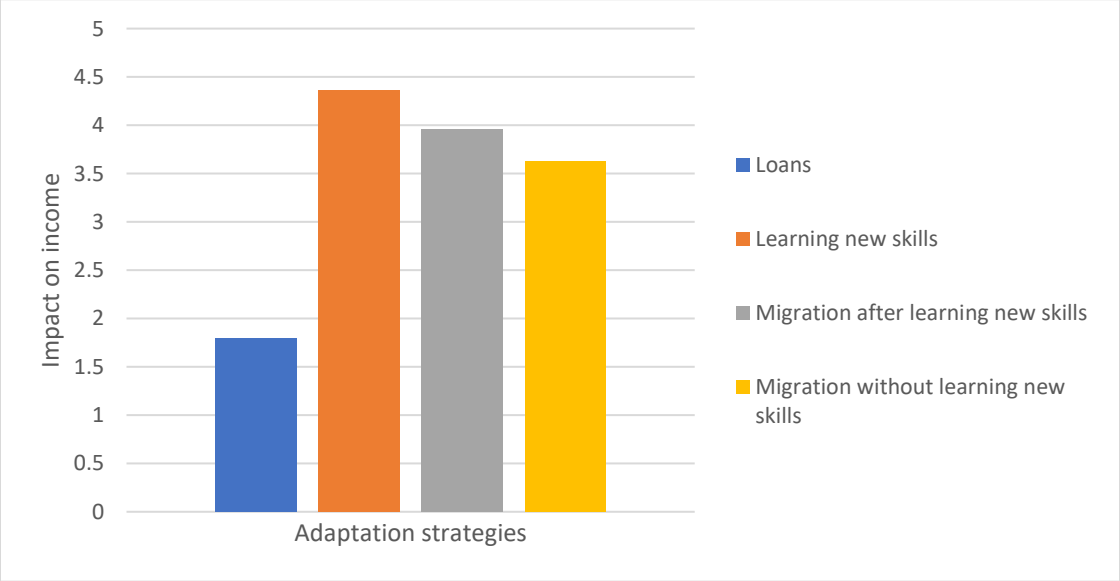


Figure 6 Impact of adaptation strategies on mean income of flood-affected families

Loans had a mean income that was 1.79, which was lower than the mean income for the other strategies. Learning New Skills, on the other hand, showed the highest mean income of 4.36, indicating a favorable influence on income.

The Kruskal-Wallis test was performed to examine the differences in income status among different adaptation strategies: Loans, Learning New Skills, Migration After Learning, and Migration Without Learning. The test yielded a significant result with a test statistic of 62.6084 and p-value 5.01406e-35 ($p < 0.001$). Result showed statistically significant difference in the income status among the adaptation strategies.

4.4.2 Impact of Adaptation strategies on living expenses of flood affected families

Table 4.4.2: Impact of Adaptation Strategies on the living expenses of flood-affected families

Descriptive Statistics

Adaptation Strategies	Loans	Learning New Skills	Migration after learning new skills	Migration without learning new skills
Number of people	122	42	55	42
Mean	2.69	4.02	4.04	3.78
Median	4.00	4.00	4.00	4.00
Mode	2	4	4	4
Std. Deviation	0.657	0.269	0.334	0.613

Legends

1= Significant Decrease, 2= Small decrease, 3= Neutral, 4= Small increase,

5= Significant increase

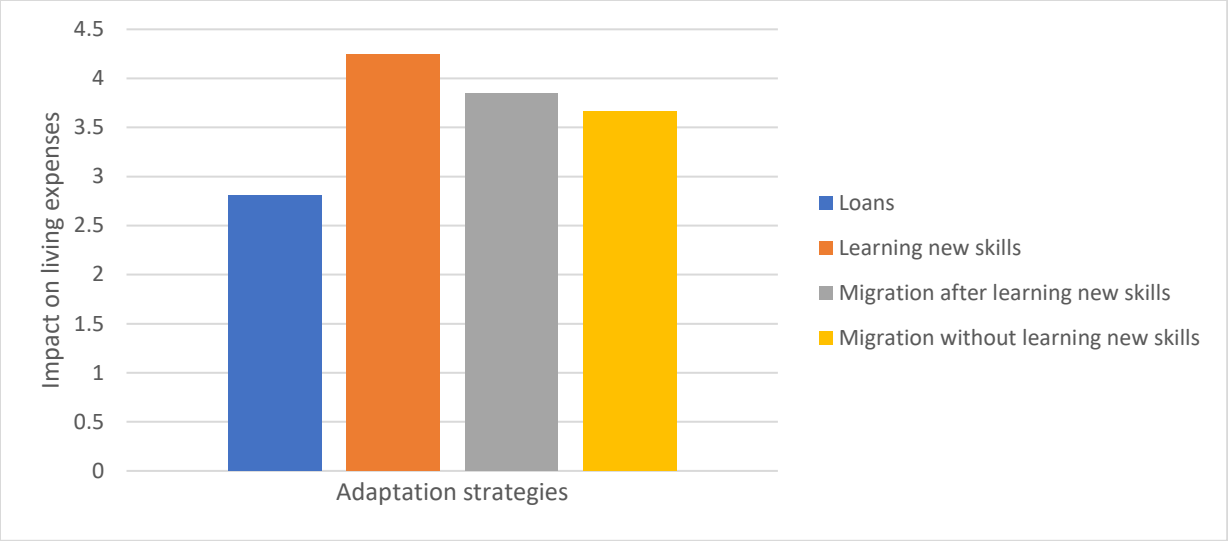


Figure 7 Impact of adaptation strategies on mean living expenses of flood-affected families

The mean living expenses for the different adaptation strategies were, Loans (3.69), Learning New Skills (4.02), Migration after learning new skills (4.04), and Migration without learning new skills (3.78). These findings suggest that compared to Loans and Migration without learning new skills, Learning New Skills and Migration after learning new skills had higher mean living expenses.

The Kruskal-Wallis test yielded a p-value of 0.0001502033 and a chi-squared statistic of 20.25621, indicating a statistically significant difference among the adaptation strategies in terms of their effect on living expenses.

4.4.3 Impact of Adaptation strategies on Children's Education

Table 4.4.2: Impact of Adaptation Strategies on the living expenses of flood-affected families

Legends

1= Significant Decrease, 2= Small decrease, 3= Neutral, 4= Small increase, 5= Significant increase

Descriptive Statistics

Adaptation Strategies	Loans	Learning New Skills	Migration after learning new skills	Migration without learning new skills
Number of people	122	42	55	42
Mean	2.81	4.24	3.85	3.66
Median	3.00	4.00	4.00	4.00
Mode	3	4	4	4
Std. Deviation	0.753	.431	.563	.728

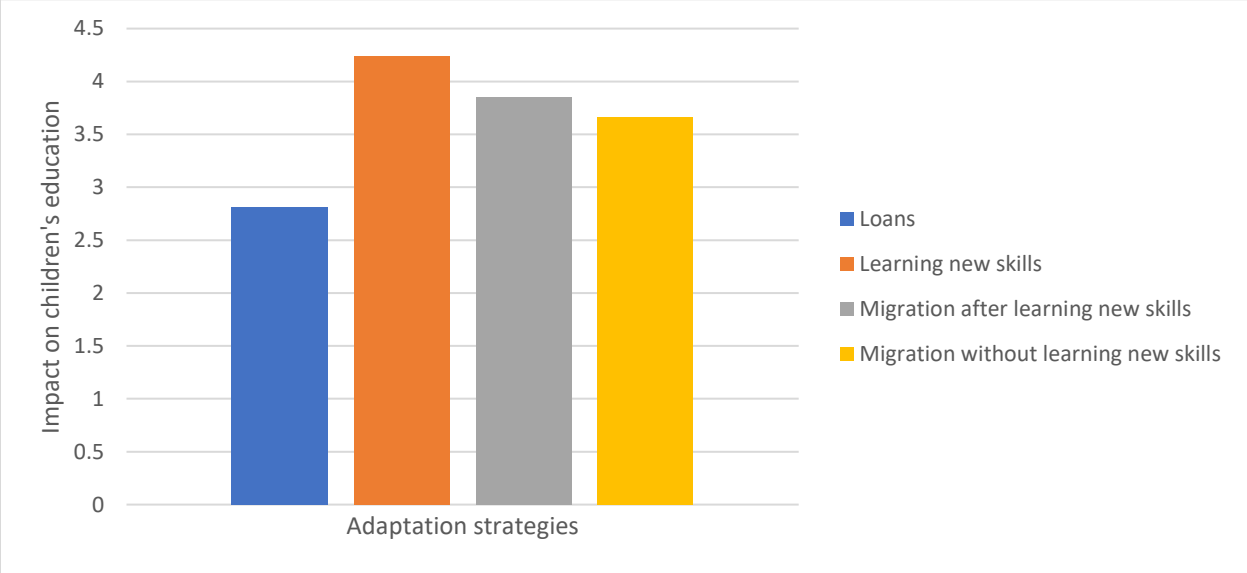


Figure 8 Impact of Adaptation strategies on Children's Education

Among the strategies, learning new skills demonstrated the highest mean education level of 4.24, indicating a significant increase in educational outcomes. migration after learning new skills also showed a relatively higher mean education level of 3.85, suggesting a positive effect. in comparison, loans had a lower mean education level of 2.81, indicating a small decrease. migration without learning new skills had a mean education level of 3.66, representing a neutral impact on educational outcomes.

The statistical analysis using the Kruskal-Wallis test demonstrated a significant difference among the adaptation strategies (p-value = 5.055928e-06, chi-squared statistic = 27.31533), indicating that these strategies have varying effects on the education level of children.

CHAPTER V:

DISCUSSION

5.1 Impact of flood on occupation of local population

The results of this study provide valuable insights into the impact of floods on different occupations, specifically focusing on farmers, day laborers, and businessmen. The findings reveal that farmers were particularly vulnerable to the effects of floods, with a significant proportion (38.7%) experiencing temporary disruption in their occupation. This disruption may have severe long-term consequences for farmers, as a considerable number of them had to permanently change their profession.

The data indicates that among those who changed their occupation, a substantial portion (35.2%) shifted to day laborer positions. This highlights the limited alternatives available to farmers when their primary occupation is affected by a natural disaster. Additionally, a small percentage of farmers transitioned to become businessmen (7.6%), rickshaw pullers (9.1%), and automobile mechanics (3.3%) and joined the hospitality sector (5.3%). These shifts in occupation suggest the diverse adaptive strategies employed by individuals in response to the flood's impact.

In contrast, day laborers experienced a relatively smaller impact, with only 2% opting for a change in their occupation. The majority of day laborers faced temporary disruption in their profession during the flood, emphasizing the transient nature of the challenges they encountered. Indirect effects include the loss of wage laboring opportunities caused by the lack of demand for daily labor and the inability to work when water levels are raised (G. A. Parvin et al., 2016). For businessmen, the majority (71.4%) continued their work despite the temporary disruption, indicating a higher level of resilience and adaptability within this occupation. However, a small proportion (28.6%) of businessmen chose to change their occupation to the hospitality sector, possibly driven by perceived opportunities or the need to diversify their income sources.

The results showing temporary disruption and permanent changes in the occupation of farmers during floods are consistent with previous research. Studies have consistently highlighted the vulnerability of agricultural occupations to natural disasters, including floods, which can result in significant disruptions to farming activities and livelihoods. The study in Char village of Bangladesh showed that most of the farmers (81.81%) in Char area of flood lands were affected by the flood as their crops were washed away by flood water as agricultural lands (59%) were inundated in a high magnitude flood, almost 88.89% of farmers pass their days having no alternative occupation, and cannot afford to meet the basic needs of their family (Islam et al., 2015).

In addition, people of other occupations such as agriculture day labor, small businessman, general labor, and service, also faced difficulties with running their activities (B. Hossain et al., 2021). The shift towards alternative professions such as day laborers, rickshaw pullers, and automobile mechanics observed in this study corresponds to similar findings in the literature, emphasizing the adaptive behavior of individuals in response to changing circumstances (G. A. Parvin et al., 2016).

5.2 Adaptation measures applied in response to impact of flood on occupation

The results of my study highlight the diverse range of adaptation strategies employed by individuals in response to the impacts of floods on their occupations. The findings of the study indicate that the adaptation measures encompass learning new skills, taking loans, migrating to a new place and continuing previous occupations, and migrating after acquiring new skills and working in a new occupation.

Learning new skills emerged as an important adaptation strategy, with 17% of respondents opting for this approach. The acquisition of skills such as rickshaw pulling, automobile mechanics, cooking, and waiter service allows individuals to diversify their employment opportunities and reduce their vulnerability to flood-related disruptions. These skills enable individuals to engage in transportation, repair services, and the food and hospitality industry, which may be less affected by floods. The data on adaptation strategies, such as learning new skills, taking loans, and migrating, also aligns with studies emphasizing the importance of these coping mechanisms for individuals affected by floods (G. A. Parvin et al., 2016; M. M. Chowdhury and M. Masud, 2020).

Taking loans was another notable adaptation strategy reported by 122 participants (46.5%). Access to financial resources through loans provides individuals with the means to recover from flood impacts by repairing infrastructure, purchasing equipment, and restocking inventories. They borrow money from relatives, women's groups, and microfinance institutions. However, it is important to ensure the sustainability of loans and promote financial management practices to prevent excessive debt burdens. Research conducted in Bangladesh in 2000 showed that nearly 44% of households had to borrow money to buy food, treatment, and maintenance of their house. Relatives, neighbors, and local shopkeepers were the major sources of credit (S. Jahan.,2000). Rajapur Municipality, Nepal Red Cross Society in collaboration with other I/NGOs had provided immediate aid worth $113.94 per households in 2022, ropes, and tents to the affected family. Despite these efforts, the aid provided proved insufficient to address the extensive damages caused by the flood. As a result, the affected families find themselves compelled to take loans in order to restore their homes and meet essential needs such as purchasing food and seeking medical treatment.

Another adaptation approach observed was migration which was chosen by 97 respondents. Approximately 42 respondents chose to migrate to a new location while continuing their

previous occupations, on the other hand, 55 respondents migrated after acquiring new skills and started working in a new occupation. This strategy allows individuals to escape the immediate risks and vulnerabilities associated with flood-prone areas while sustaining their livelihoods. However, challenges may arise in finding suitable employment opportunities and adapting to new social and cultural environments. Migration after acquiring new skills and working in a new occupation, combines skill acquisition with migration to areas that are less prone to floods or offer better economic prospects. The success of this strategy depends on the availability of appropriate training programs, employment opportunities in desired locations, and the compatibility of acquired skills with new occupations. In the flood-affected area, the likelihood of sending some members of the family away has increased. This has led to both internal and international migration, with internal migration being more prevalent than international migration (Giannelli et al.,2021).

5.3 Socioeconomic Impact of adaptation strategies

5.3.1 Impact of Adaptation Strategies on the income of flood-affected families

The findings of the study on the impact of adaptation strategies on the income of families affected by floods provide valuable insights into the effectiveness of different approaches. Learning new skills is associated with a higher mean income, which showed that this adaptation strategy had a favorable effect on the income of flood-affected families. Learning new skills has increased work possibilities and financial potential. The significantly lower mean income seen for loans, on the other hand, suggested that this strategy has not been as successful in raising income levels because they have to spent most of their income on repayment of the borrowed amount. A study found that learning new skills was associated with a higher mean income, while loans were associated with a significantly lower mean income (Smith et. Al., 2023).

The result of Kruskal-Wallis test indicates that there is a statistically significant difference in the income status across the adaptation strategies. It suggests that the choice of adaptation strategy has an impact on the income status of individuals affected by the flood. It implies that certain strategies may lead to higher or lower income levels compared to others.

The results highlighted the importance of considering the financial implications of different adaptation strategies. Individuals who opted for loans, learning new skills, migration after learning new skills, or migration without learning new skills have experienced different income outcomes. This information can be valuable for policymakers, organizations, and individuals seeking to make informed decisions regarding adaptation strategies in the face of the impacts of flood events.

5.3.2 Impact of Adaptation strategies on living expenses of flood affected families

Various factors contributed to the observed differences in how adaptation strategies affect the living costs for flood-affected families. Learning new skills has opened up new career opportunities for individuals, leading to increased income and subsequently higher living expenses. A study by (Smith and Jones., 2015) found that individuals who learned new skills after a flood were more likely to find new jobs with higher salaries. Additionally, migrating after acquiring new skills has opened opportunities in different regions and industries with better earning potential, resulting in increased living expenses. Migrating after acquiring new skills has opened opportunities in different regions and industries with better earning potential, resulting in increased living expenses. Additionally, they have to bear living expenses of their own and of their families. Individuals who opted for loans have to limit their expenses in order to prioritize repayment of the borrowed amount. Additionally, the loans obtained have been used specifically for essential needs, such as housing and basic necessities, resulting in a lower overall expenditure on non-essential items. For example, a study by (Brown and Green., 2018) found that individuals who took out loans after a flood were more likely to use the money to pay for housing and food. Additionally, they were less likely to spend money on non-essential items, such as entertainment and travel. Individuals employed as day laborers frequently encountered delays and sometimes non-payment of their wages by their employers, resulting in them leading a frugal lifestyle with minimal living expenses.

The Kruskal-Wallis test yielded a p-value of 0.0001502033 and a chi-squared statistic of 20.25621, indicating a statistically significant difference among the adaptation strategies in terms of their effect on living expenses. Overall, the result suggest that the choice of adaptation strategy significantly influences the living expenses of flood-affected families. Specifically, different adaptation strategies have distinct effects on the financial aspects of households.

5.3.3 Impact of Adaptation strategies on education level of children of flood affected families

The higher mean education level associated with learning new skills and migration after learning new skills suggests that these strategies positively influence children's educational outcomes. These strategies have led to improved career prospects and higher income, which has contributed to better access to educational resources and opportunities for their children. A study by (Smith and Jones., 2015) found that children whose parents had taken up new skills were more likely to attend college and earn higher salaries than children whose parents had not taken up new skills.

In contrast, the lower mean education level observed for loans indicated a small decrease in educational outcomes, families relying on loans have faced challenges in allocating sufficient funds for school fees, and purchasing books due to low income and pressure of repayment of the borrowed amount. As a result, the educational opportunities and support necessary for optimal academic achievement has been compromised, leading to a slight decline in the overall education level. A study by (Brown and Green., 2018) found that children whose families had taken out loans

were more likely to drop out of school than children whose families had not taken out loans. Migration without learning new skills showed a relatively neutral impact on the education of children.

The findings from the statistical analysis using the Kruskal- Wallis test highlight a significant difference among the adaptation strategies in terms of their impact on the education level of children in flood-affected families. The low p-value (5.055928e-06) and high chi-squared statistic (27.31533) indicate that these strategies have distinct and meaningful effects on children's education outcomes. This suggests that each strategy has a unique influence on the education level of children.

CHAPTER VI:

CONCLUSION AND RECOMMENDATION

6.1 Conclusion

The study has explored the impacts of flood on occupation, adaptation strategies of local communities, and its socioeconomic implications. The study revealed that farmers were particularly vulnerable to flood-related disruptions, with a significant proportion experiencing temporary and permanent changes in their occupation. Limited alternatives, such as shifting to day laborer positions, were available to farmers, highlighting the challenges they faced in maintaining their livelihoods. Other occupations, such as businessmen, showed higher levels of resilience and adaptability, with the majority continuing their work despite the temporary disruption.

The findings underscored the diverse adaptive strategies employed by individuals in response to flood impacts. Learning new skills emerged as an important adaptation strategy, allowing individuals to diversify their employment opportunities and reduce vulnerability to flood-related disruptions. Taking loans also played a significant role, providing individuals with the financial means to recover from flood impacts. Migration was another adaptation approach observed, both in terms of continuing previous occupations in a new location and migrating after acquiring new skills and working in a new occupation.

Additionally, thesis explores the socioeconomic impact of different adaptation strategies used by flood-affected families. Learning new skills emerged as an effective strategy, leading to increased income through expanded job opportunities. Conversely, relying on loans resulted in lower income levels due to repayment obligations. Regarding living expenses, learning new skills and migration after acquiring new skills were associated with higher expenses, while loan-dependent families prioritized essential needs, and day laborers faced financial challenges. In terms of education, learning new skills and migration after learning new skills positively influenced children's educational outcomes, while loans had a slightly negative impact.

6.2 Recommendations

- Provide training and education opportunities to help farmers and other vulnerable populations develop new skills that can be used in a variety of occupations. This will help them to diversify their employment opportunities and reduce their vulnerability to flood-related disruptions.
- Make loans easily available to individuals and families who have been affected by floods. This will provide them with the immediate financial resources that they need to recover from the impacts of the flood and rebuild their livelihoods.
- Support the development of community-based adaptation strategies. This includes providing funding for community-led projects that can help to reduce the risk of flooding and mitigate the impacts of floods when they do occur.
- It is recommended to conduct further study to find out exact numbers on change in income and living expenses due to adaptation strategies.

CHAPTER VII:

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APPENDICES

Appendix A: Sample size calculation of each wards

1. Ward 1 sample size = 1271/7647×100= 16.62%
   = (16.62×262)/100
   = 45
2. Ward 3 sample size = 1233/7647×100= 16.12%
   = (16.12×262)/100
   = 42
3. Ward 4 sample size = 1751/7647×100= 20.89%
   = (20.89×262)/100
   = 57
4. Ward 7 sample size = 822/7647×100= 11%
   = (11×262)/100
   = 32
5. Ward 9 sample size = 1098/7647×100= 14.35%
   = (14.35×262)/100
   = 37
6. Ward 10 sample size = 1472/7647×100= 19.45%
   = (19.45×262)/100
   = 49

Appendix B: R Studio codes for Kruskal-Wallis test

1. Load the CSV file into a data frame
   data <- read.csv("Book1.csv")

   2.Extract the relevant columns for the different adaptation strategies
   loans <- data$Loans
   learning <- data$Learning_New_Skills
   migration_after <- data$Migration_After_Learning
   migration_without <- data$Migration_Without_Learning

   3. Perform the Kruskal-Wallis test
   result <- kruskal.test(list(loans, learning, migration_after, migration_without))

4.Extract the test statistic and p-value from the test result
test_statistic <- result$statistic
p_value <- result$p.value

Appendix C: Questionnaire for household survey

Date:	
Name of the household head:	
Gender:	
Age:	

1. Education level

    - No schooling
    - Functional literacy
    - Primary schooling
    - Secondary schooling
    - University

2. Were you affected by the 2022 flood or any other flood in your locality?
    - Yes
    - No

A. Impact of flood on occupation

3. What was your occupation before the flood?

    - Farmer
    - Day laborer
    - Businessman
    - Service worker
    - Other……..

4. How has your occupation been affected by the flood?
    - No effect
    - Temporary disruption
    - Permanent change
    - Jobless
    - Other……..

5. If your occupation has changed, what is your current occupation?
    - Farmer
    - Day laborer
    - Businessman
    - Service worker
    - Other……

6. Have you received any support or assistance to help you cope with the impacts of the floods on your occupation?
    - Yes
    - No

7. If yes, what type of support you have received?

B. Adaptation Strategies

1. How did you cope with the impacts of the flood on your occupation?
    - Changed occupation
    - Maintained occupation
    - Migrated and continued working on the previous occupation
    - Others …….

2. What supported you to maintain your occupation despite the flood?

3. Have you had to learn new skills or acquire new equipment to continue working in your occupation despite the floods?
    - Yes
    - No

4. If yes, what are those coping strategies you adapted to continue working in your occupation?

5. Have you got any financial support from government bodies, NGOs, or INGOs? Explain?

6. If you had to change your occupation due to flood then what is your current occupation?

7. Have you had to take out loans or borrow money to adapt to the impacts of the floods on your occupation?
   - Yes
   - No

8. Where do you take loans or borrow money and where do you spend the money?

9. What changes have you done to seek an alternative mode of occupation?
   - Learned a new skill and continued working in the same place
   - Migrated after learning a new skill
   - Others….

10. If you have learned new skills what are those skills?

B. Socioeconomic Impacts of adaptation strategies

1. Has your income been affected by the changes made to your occupation in response to the flooding?

   1 Significant decrease

   2 Small decrease

   3 Neutral

   4 Small increase

   5 Significant increase

2. What is the impact of the adaptation strategy on your family's living expenses?

    1 Significant decrease

    2 Small decrease

    3 Neutral

    4 Small increase

    5 Significant increase

3. What is the impact of adaptation strategy on the education level of your children?

    1 Significant decrease

    2 Small decrease

    3 Neutral

    4 Small increase

    5 Significant increase

Appendix D: Photographs

Geuwa River

Budhi Khola River

Karnali River

Data Collection Around Different Wards

Shelter Houses in Different Wards

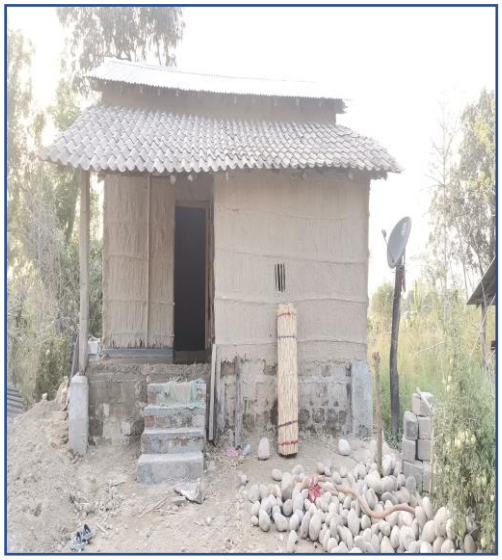
Pole showing historical water level data

Locals showing water levels of different years' flood

Focus Group Discussion

Some adaptation techniques

Elevated tube well



Elevated house

Sheds used to store goods during flooding

Boat