EVALUATION OF DISASTER RISK MANAGEMENT: A CASE STUDY OF GILGIT BALTISTAN

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CERTIFICATE

This is to certify that this thesis entitled: **"Evaluation of Disaster Risk Management: A Case study of Gilgit Baltistan"** submitted by Wajhullah Fahim is accepted in its present form by the PIDE School of Social Sciences, Pakistan Institute of Development Economics (PIDE), Islamabad as satisfying the requirements for partial fulfillment of the degree in Master of Philosophy in Public Policy.

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Author's Declaration

I **Wajhullah Fahim** hereby state that my MPHIL thesis titled **EVALUATION OF DISASTER RISK MANAGEMENT: A CASE STUDY OF GILGIT BALTISTAN** is my own work and has not been submitted previously by me for taking any degree from the Pakistan Institute of Development Economics or anywhere else in the country/world. At any time if my statement is found to be incorrect even after my Graduation the university has the right to withdraw my MPhil degree.

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Dedication

This thesis is dedicated to my beloved parents Mr. and Ms. ***GHULAM MUHAMMAD (ZUHARI),*** whose unwavering support and encouragement have been my guiding light throughout this journey. Your endless sacrifices and boundless love have made all of this possible.

To my brother, ***Mr. MUSTAFA AQEEL,*** whose constant belief in me has been a source of strength and motivation. Your camaraderie and wisdom have been invaluable.

To my entire family, thank you for your constant encouragement, love, and understanding. Your faith in me has been my anchor and my inspiration.

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ABSTRACT

Gilgit-Baltistan (GB) is located in the northern part of Pakistan. Due to its unique geographical location in the Himalayan, Karakoram, and Hindu Kush Mountain ranges. This region is highly vulnerable to climate change and disaster events. In GB, the Gilgit Baltistan Disaster Management Authority (GBDMA) was established in 2017 to better manage and minimize the devastating impacts of disaster events and now disaster management authorities are established in all ten districts of GB. However, consequences and losses from disasters are not reduced significantly. So, this study was designed to evaluate the effectiveness of GBDMA in the implementation of DRR measures in District Skardu. Key-informant interviews were conducted with government agencies, academia, and non-government organizations and thematic analysis was used for interpretation and analysis of data. The lack of proper risk assessment, vulnerability assessment, and disaster preparedness plan, and insufficient resources (capital, financial, and human) concluded the ineffectiveness of GBDMA implementation of DRR. In GB for effective implementation of DRR, scientific-based disaster risk, and vulnerability assessment, digitization of disaster authority, and implementation of a bottom-up approach are some recommended measures.

Flood insurance can be used as a tool for transferring disaster risks. This study also determined WTP for flood insurance by using a discrete choice model. With the help of a survey questionnaire and choice cards, primary data was collected from 102 respondents. The results showed that people were willing to pay for flood insurance, but affordability was the main issue. Further people preferred the government as a provider, so the government of GB should take flood insurance initiative with the collaboration of private companies and international climate financing organizations.

Keywords: Disaster; Climate Change; DRR; Flood Insurance; Gilgit Baltistan; Flood; People

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LIST OF ABBREVIATIONS

GB	Gilgit Baltistan
GLOF	Glacier Lake Outburst Flood
DRR	Disaster Risk Reduction
DRM	Disaster Risk Management
NDMA	National Disaster Management Authority
GBDMA	Gilgit Baltistan Disaster Management Authority
DDMA	District Disaster Management Authority
SDA	Skardu Development Authority
GB-PWD	Gilgit Baltistan Public Works Department
P&D	Planning and Development
PHE	Public Health Engineering
GBRSP	Gilgit Baltistan Rural Support Program
AKRSP	Aga Khan Rural Support Program
LG& RD	Local Government and Rural Development
UNDP	United Nations for Development Program
UoB	University of Baltistan
WTP	Willingness to Pay
DCM	Discrete Choice Model
CLM	Conditional Logistic Model
MLM	Multinominal Logistic Model
PMT	Protection Motivation Theory
GoP	Government of Pakistan
GoGB	Government of Gilgit Baltistan
CVM	Contingent Valuation Model
DCM	Discrete Choice Model
EWS	Early Warning System

Chapter 1
INTRODUCTION

1.1 Background

Climate change has become a global challenge. About 3.3 to 3.6 billion people worldwide are highly vulnerable to climate change (Lee et al., 2024). Extreme weather events such as drought, and flood have produced adverse impacts on communities in Asia, Africa, Central America, and South America (Parmesan et al., 2023). Globally the occurrence of natural hazards and disasters such as earthquakes, mass movement, storms, and wildfires events in 2023 has been higher than the average occurrence from 2003 to 2022 as described in Figure 1 (CRED, 2024). The average number of events occurring from 2003 to 2022 was 369, while in only 2023 a total of 399 catastrophic events were recorded (CRED, 2024). The highly vulnerable regions faced 15 times higher mortality rates than the low-vulnerable regions due to floods, storms, and drought from 2010 to 2020 (Parmesan et al., 2023). According to CRED (2024) in 2023 more than 93 million people were affected by different types of disaster events and the economic losses of these events were more than USD 202 billion.

Figure 1: **Frequency of Natural Disaster Events**
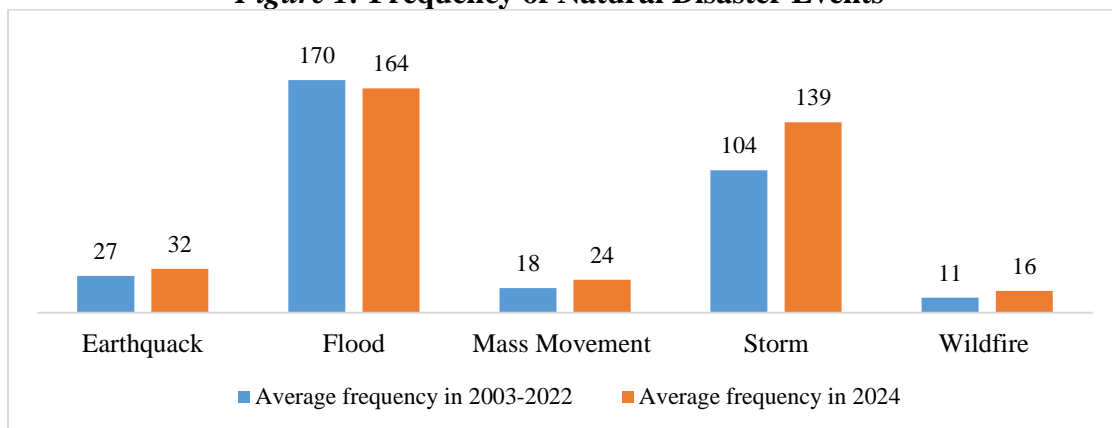
(Source Centre for Research on the Epidemiology of Disasters-CRED)

Developing countries are more vulnerable to climate change, as eight out of ten countries in the Global Climate Risk Index 2021 are developing countries, Pakistan ranks 8th in the index (Eckstein et al., 2021). The climate changes in Pakistan can be observed in changing precipitation patterns, temperature levels, increasing frequency

of tropical storms, melting of glaciers, rising sea levels, and loss of biodiversity(GoP, 2022).

The European Commission and different UN agencies developed the "Inform Risk Index" for disaster risk management and Pakistan ranks 23rd out of 191 countries for the highest disaster risk level (Inform Risk Index, 2024). This index incorporated the level, magnitude, intensity, and coping capacity of natural disaster events for a particular region based on three broader dimensions, Hazard Exposure, Vulnerability, and Lack of Coping capacity. Pakistan's profile in the Inform Risk Index is presented in Table 1. It shows in addition to being highly hazardous and vulnerable, the lack of coping capacity is also intensifying the disaster risk level in Pakistan.

Table 1: **Profile of Pakistan in Inform Risk Index**

Dimension	Score	Level
Hazard and Exposure	7.2	Very High
Vulnerability	5.9	High
Lack of Coping Capacity	5.3	High
Inform Risk Index	6.1	High

(Source Inform Risk Index 2024)

During the last five decades the average temperature of Pakistan has increased by 0.5ºC and at the end of this century temperature is expected to increase by 3ºC to 5 ºC that will change rainfalls and glacier melting patterns (Chaudhry, 2017) . Pakistan has faced 152 extreme weather events in the last two decades and the estimated economic losses due to these disasters are USD 3792.5 million (Eckstein et al., 2021). The flood in 2022 is the recent example in which one-third of the country was under-water and the estimated loss to GDP was recorded at the tone of USD 14.9 billion (GoP, 2023). As a result of climate change and glaciers melting like other provinces of Pakistan, Gilgit Baltistan (GB) was also affected by the 2022 flood. The Gilgit Baltistan Disaster Management Authority (GBDMA) estimated 111 events of floods occurred in GB in 2022. The division-wise detail is shown in and Figure 2

Figure 2: Number of Flood Events in Gilgit Baltistan (2022)

Gilgit — 59
Baltistan — 37
Diamer — 15

Divsion in GB

(Source GBDMA, 2023)

Different national and international organizations estimated damage and losses caused by the natural disasters in GB. A reported of causalities and injuries in GB from 2010 to 2022 is depicted in the Figure 3. As a result of disasters, 293 people lost their lives and 163 people got injured during this period, as per government data.

Figure 3: Reported Summary of Deaths and Injured People from Natural Disasters in GB (2010-2021)

Gilgit — 83, 53
Baltistan — 77, 27
Diamer — 133, 82

Divisions in GB

■ Deaths   ■ Injured

(Source GoGB, 2023)

Gilgit Baltistan is one of the highly vulnerable regions to climate change due to its location in the mountain ranges of the Himalayan, Karakoram, and Hindu Kush (HKH). Many studies have documented the high climate vulnerability of the HKH region. The findings of Bhatta et al. (2020) have confirmed that the average temperature in these regions has risen by 0.10ºC per decade from 1901 to 2014. Due to the increase in average temperature glacier melting has become a prominent issue. The study by Shah and Rana (2023) highlighted about 67% of glaciers in Himalayan regions are melting at an exponential rate. As a result of glaciers melting frequencies of natural disasters

such as Glacial Lake Outburst Floods (GLOF), land sliding, and flash floods have increased in HKH regions. The United Nations Development Programme (UNDP) (2019) confirmed thirty-three lakes in northern Pakistan, which are highly vulnerable sites for GLOF. According to Ali (2020), the International Centre for Integrated Mountain Development (ICIMD) surveyed 250 villages in GB and concluded that 46 percent of them are facing different types of natural hazard events and the most frequent and dominant natural hazardous events are land sliding, earth-quacks, flash floods, soil erosions, rock fall, and glacial outburst floods.

The GBDMA and UNDP calculated the economic losses and consequences of the floods in 2022 of GB. According to Business Recorder (2022) , the GBDM estimated PRS 7406 million in losses from different flood events. While UNDP calculated the affected total areas and house damages as a consequence and damage of floods in 2022. The Figure 4 and Figure 5 manifests land and house losses and damages in GLOF II projected areas of the Baltistan division.

Figure 4: Land Damages in GLOF II projected areas of Baltistan Division
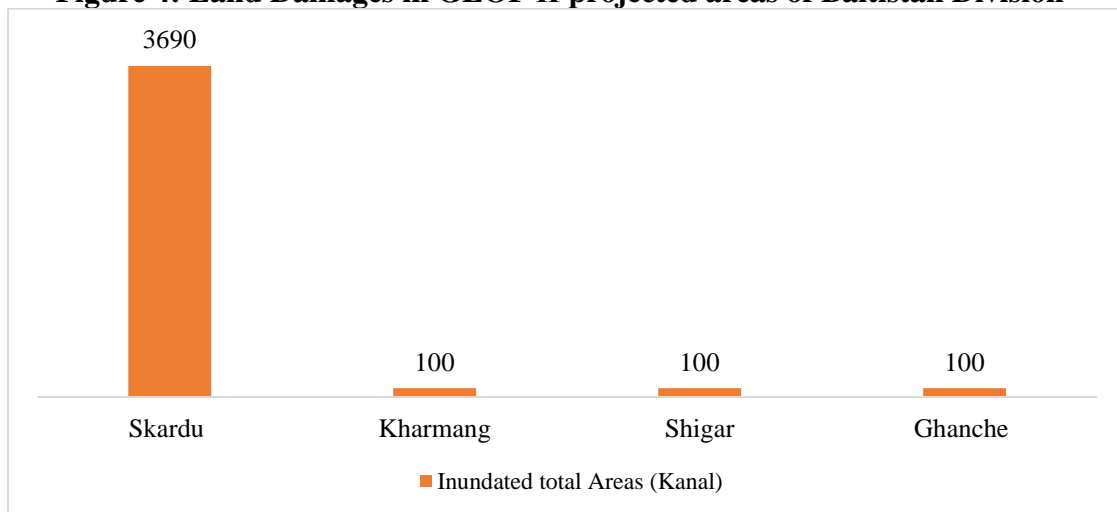
(Source UNDP, 2023)

Figure 5: House Damages in GLOF II projected areas of Baltistan Division
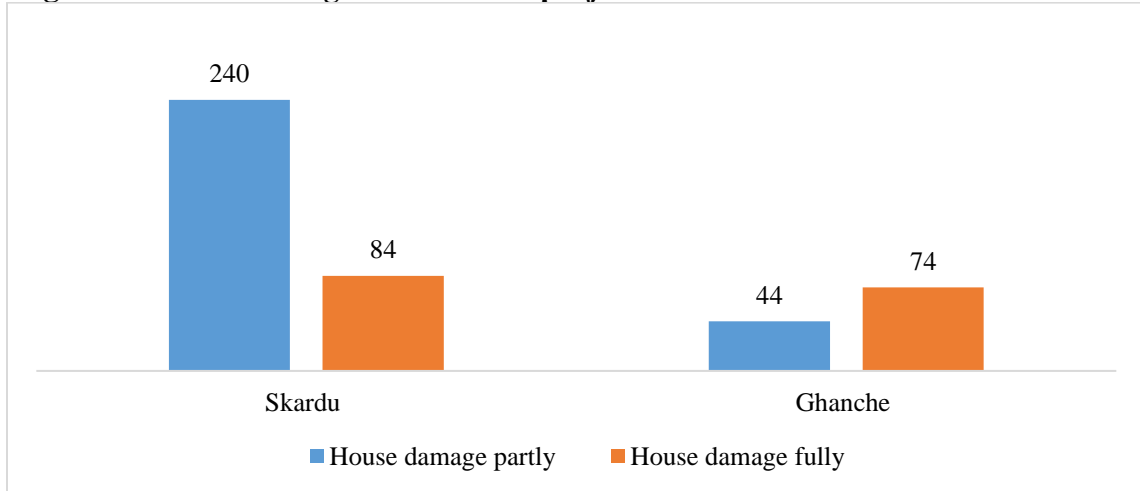
(Source UNDP, 2023)

The catastrophic impacts of climate change have resulted in the formation of global disaster risk reduction (DRR) frameworks. The Hyogo Framework for Action 2005-2015 and Sendai Framework for DRR 2015-2030 stress all nations to invest in building resilient communities by ensuring DRR in their local and national priorities along with strong institutional frameworks for DRR (Shah et al., 2020).

To better manage disaster risk, the Sendai Framework of Risk Reduction 2015-2030 defines four key priorities. The second priority stresses "Strengthen governance of disaster management at the national and sub-national levels" (UNDRR, 2015). To improve the governance of disaster management in GB, the Gilgit Baltistan Legislative Assembly passed the act "Gilgit Baltistan Disaster Management Authority Act 2017" and shifted the implementation power of disaster policies and measures to the district-level (GoGB, 2017). Besides such efforts, consequences from disasters are not reduced in GB such as 360 million financial losses incurred in GB due 2022 floods (Pamir Times, 2022). This indicates that disaster management has not improved significantly in GB and needs to identify issues and bottlenecks in the governance structure of GBDMA by focusing on the implementation of disaster-related policies and measures in GB.

The third priority of the Sendai framework outlines "Investing in disaster risk reduction for resilience" (UNDRR, 2015). There are two approaches to making communities resilient to flood; structural and non-structural approaches (Mysiak et al.,

2016).The structural approach emphasizes the construction of climate resilience infrastructure such as the construction of dams, which require considerable resources and time (Hudson, 2017). Under such conditions, a non-structural approach can be used as an alternative mechanism. The non-structural approach involves soft solutions such as flood insurance. Currently, in the case of GB, there is no established market for flood insurance. Before initiating such a mechanism, it is necessary to study its feasibility.

Thus, disaster management requires holistic approaches combined with strong institutional mechanisms with different types of measures. GB is highly vulnerable to climate change and disaster events. It has become necessary to have a strong institutional setup compound with non-structural approaches. This study is designed to evaluate institutional effectiveness along with the acceptability of flood insurance in managing and transferring disasters and their associated risks.

1.2 Institutional Engagement and DRR in Pakistan

In Pakistan, before the 2005 earthquake, the Calamity Act 1958 was the only policy document for dealing with disaster events (Bacha, 2017). This document dealt with pre-disaster measures only. There was no mechanism for post-disaster management (Shaw, 2015). After the devastating 2005 earthquake, the President of Pakistan passed the Ordinance of National Disaster Management known as National Disaster Ordinance 2006, to improve disaster risk management at the federal, provincial, and district levels. NDMA, (2012). This was a milestone step for proper disaster management plans and policies in Pakistan. In 2007 the National Risk Management Framework was developed by the government of Pakistan with the collaboration of the United Nations (Arshad and Shafi, 2010). Under this framework, different measures such as institutional arrangement, assessment of disaster hazards and vulnerability, disaster education, establishing an early warning system, awareness, and training for local communities are identified as disaster policy measures in Pakistan. Furthermore, different agencies such as the Water and Power Development Authority (WAPDA), Federal Flood Commission (FFC), Civil Defense, and Pakistan Army are included as partner disaster management agencies for the implementation of DRR, response and recovery activities, and rehabilitation of disaster victims. The National Disaster Management

Ordinance converted to the National Disaster Management in 2010. The details of the act are explained in   Figure 6

Figure 6: **Framework of the National Disaster Management Act 2010**
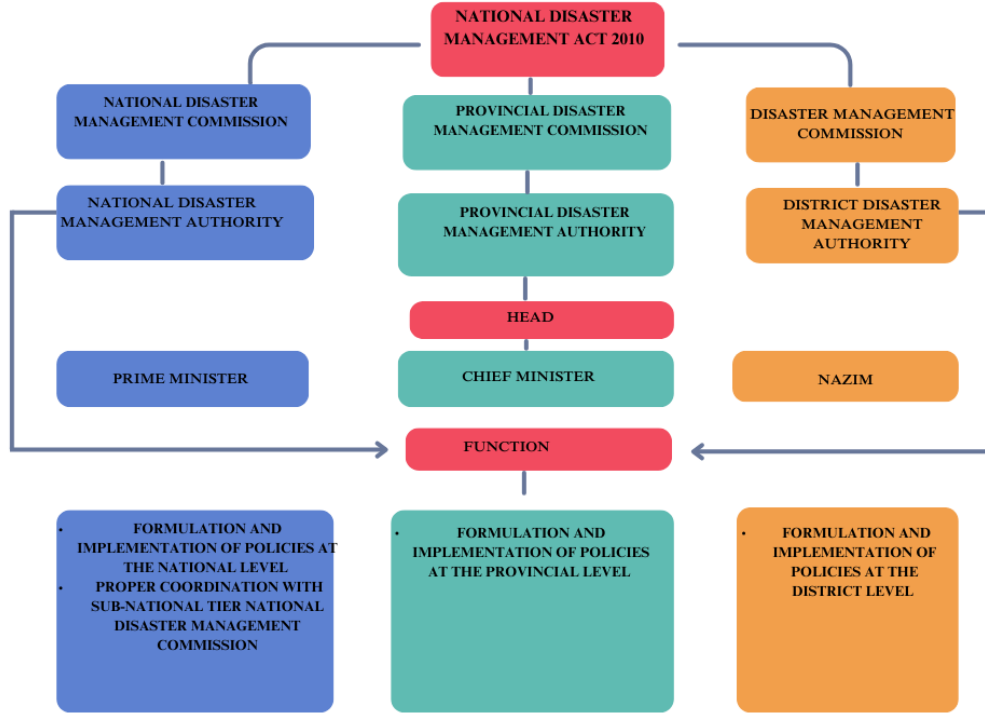
(Source NDMA Act 2010)

Following the National Disaster Management Act 2010, the Gilgit Baltistan Assembly passed the act of Gilgit Baltistan Disaster Management Authority in 2017 and transferred the disaster-related policy implementation power to the district administration (GoGB, 2017).

1.3 Statement of the Problem (SoP)

GB has become highly vulnerable to climate change. Due to increasing disaster vulnerability, both the frequency and intensity of different types of disaster events also increase in GB. Thus, it demands comprehensive and holistic disaster management mechanisms. A strong institutional setup is one of the main components of a comprehensive and holistic disaster management mechanism. In GB, disaster management authorities are established to improve disaster risk management and

governance. However, consequences and losses from natural disasters are not significantly minimized in GB. This shows serious governance issues in disaster management authorities in GB.

Along with institutional setup, structural and non-structural approaches are also components of a comprehensive disaster management mechanism. Since the structural approach (hard solutions) involves huge financial resources and time completion. Thus, the non-structural approach (Soft solution) can be used as a tool to make the community resilient against floods. With the help of this approach, disaster and flood risks can be reduced and transferred. But in GB, there is no market for flood insurance, so it is important to measure its acceptability first. This study determines the acceptability of flood insurance as a tool/measure to reduce and transfer flood risks in the District of Skardu along with the barriers faced by disaster management authorities in the effective implementation of disaster risk reduction.

1.4 Research Problem

After the act of GBDMA 2017, along with the Director General of Disaster Management Authority at the province level, the Director Office at the division level, and the Assistant Director Office at the district level are also established in GB (Shah and Rana, 2023). Besides such efforts, damages, and losses from natural disasters aren't reduced. But scientifically there is no evidence for both the effectiveness of disaster management authorities and the barriers faced by them in implementing DRR in GB.

Along with the establishment of institutional setup, structural (hard solution) and non-structural (soft solution) also can be used to make the community resilient against disaster and flood risks. Since the structural approach such as the construction of climate-resilient infrastructures involves high financial cost and time costs. Along with this, post-flood relief operations in Pakistan are also problematic due to elite capture, bureaucratic issues, financial constraints, and nepotism. Under such constraints, the flood insurance market is a better alternative to manage issues faced by victims during and after flooding. But, the acceptability of this alternative has not been studied so far, to the best of our knowledge. So, this study is designed to study the acceptability of flood insurance in District Skardu as an alternative way to transfer flood risks.

1.5 Objective of Research

The following are the objectives of the research,

- To measure the effectiveness of the District Skardu Disaster Management Authority in the implementation of disaster risk reduction.
- To measure community willingness to pay for flood insurance in District Skardu
- To identify the key factors deriving willingness to pay for flood insurance.

1.6 Research Questions

The following are the research questions,

- How Skardu Disaster Management Authority is effective in implementing Disaster Risk Reduction?
- Is the community of District Skardu willing to pay for flood insurance?
- What are the key factors deriving willingness to pay for flood insurance?

1.7 Significance of the Study

This study can help in improving governance issues in the District Disaster Management Authority of District Skardu by explaining the barriers and challenges faced by DDMA during the implementation of DRR in District Skardu. Secondly, flood risks can be minimized and transferred with the help of soft solutions like flood insurance. In Gilgit Baltistan, there is no market for flood insurance, with the help of this study acceptability of flood insurance in district Skardu has been determined. This study can also help financial institutions as their go-to-market report or feasibility study for launching an insurance business in GB. A new financial market can be introduced in District Skardu for better risk management and risk transfer for the local communities of District Skardu.

Chapter 2
LITERATURE REVIEW

The literature related to this study has been presented in this chapter. This chapter is divided into four parts. In the first part, the effectiveness of implementing DRR is explained in the context of Decentralized Disaster Management Authorities. In the second part, I discussed how the District Disaster Management Authorities are effective in the implementation of DRR. Along with this, barriers and challenges are also explained that are faced by District Disaster Management Authorities during the implementation of DRR. In the third portion of this chapter, I have presented literature about the WTP for flood insurance by using the Discrete Choice Model. This portion further consists of two parts. In the first part, different attributes and attribute levels of hypothetical insurance products are explained while in the second part effects of socioeconomic factors such as age, education, and past flood experience are discussed that play important roles in the respondent WTP for flood insurance. In the last portion of this chapter, the theoretical and conceptual framework of this study is explained.

2.1 Disaster Risk Management

There are two main mechanisms for managing disaster risks, centralized and decentralized disaster risk management. In centralized disaster risk management, state/federal actors are the main actors in managing disaster risks while in decentralized mechanisms provincial or district-level actors are the main actors. As the objective of the study is to determine the effectiveness of DDMA Skardu in implementing DRR. So, the literature on decentralized disaster management authority is explained followed by specifying DDMAs in the implementation of DRR measures.

2.1.1 Decentralized Disaster Management

In development and policy discourses, decentralization asserts the devolution of power and resources from national to sub-national levels. In decentralized disaster management, different actors and stakeholders at the local level actively engage in day-to-day decisions about hazard impacts and disaster risks (Garschagen, 2016)

2.1.2 Disaster Risk Reduction and Decentralized Disaster Management

The impacts of disasters vary according to the demographics characteristic of communities and DRR requires collaboration of multiple sectors, stakeholders, and actors for effective results and outcomes. In the case of decentralized disaster management, the involvement of multiple sectors, stakeholders, and actors became possible and better measures of DRR could be implemented (Miller and Douglass 2016). In addition to collaboration, a network-based mechanism is also necessary for better results and outcomes of any measures (Lee, 2019). Feiock (2007) and Waugh, (2003) mentioned decentralized disaster structures as effective and efficient ways to collaborate across sectors and actors and network-based mechanisms. According to them, there are two features of the collaborative and network-based mechanism that helped in better results and outcomes of measures. The two features are "Internal and External Networks". The Internal network means the involvement of local stakeholders and the External network means close interaction with other local governments while according to Lee (2019), with the help of a decentralized disaster mechanism, the external network could develop easily and the impacts of disasters could be minimized.

For better DRR and disaster risk management, along with vertical and horizontal coordination direct engagement with local communities is a prerequisite condition Shah et al., (2020). Skidmore and Toya, (2013) stated that the decentralization of disaster management is a better way of coping with disaster events. According to them, local governments and communities have a better understanding of local conditions and vulnerability as a result they can prepare and implement different measures more effectively. Furthermore, Baker and Refsgaard, (2007) mentioned during complex disaster events, rapid change in DRR strategies is required. In the case of a decentralized framework actors of both policy formulation and implementation are at the local level and they could easily change their strategies hence losses could be minimized.

Some researchers such as Akoh, (2018), Bae et al., (2016), Raikes et al., (2022) mentioned the necessary conditions for the effective implementation of DRR. According to Akoh, (2018) without clear roles between the central government and local government with financial autonomy to the local government DRR could not

produce effective results. Strong central government support, clear national legislation, efficient monitoring system, well-trained human skills, and private-public partnerships are necessary conditions for effective DRR. A study conducted by Kanyasan et al., (2018) identified five key themes for enhancing DRR strategies; availability of resources, coordination, capacity building, and strong institutional setup.

Along with necessary conditions, many researchers and scholars also highlight numerous constraints for the effective and efficient implementation of DRR after the decentralization of disaster management authorities. According to Bae et al., (2016), the local government faced many structural issues and also had a limited budget that acted as a potential barrier to effective and efficient implementation of DRR. Even after the decentralization of disaster mechanisms, without coordination with other trans-border based upon the sharing of ideas, technologies, and knowledge impacts of disaster could not be minimized (Miller and Douglass 2016).

In the case of developing countries, decentralized disaster management is ineffective as they are facing multiple problems such as lower human capacity, financial constraints, and technical issues (Butt et al., 2016; Jha and Geddes, 2013). Developing countries such as Mozambique, South Africa, and Bangladesh inefficient resources, lack of inter-organizational coordination, and lack of human capacity are the main factors for improper implementation of DRR (Koivisto and Nohrstedt, 2017; Solik and Penning-Rowsell, 2017; Sultana et al., 2008). Šakić Trogrlić et al., (2022) studied the decentralized disaster risk reduction mechanism of Malawi and concluded it was an ineffective mechanism to cope with disaster and its risks. They identified five factors in the ineffectiveness of DRR: hindrance in participation of local communities, limited budget, information asymmetry, donor involvement, and attitude of non-local stakeholders. The famous Indian social scientist Chandhoke, (2003) raised serious questions regarding the decentralization of disaster management authorities and DRR in Mumbai India. He stated decentralization raises complex issues of governance such as accountability issues and too much involvement of civil societies in governmental affairs and such governance issues are critical for the management of

2.1.3 Disaster Risk Reduction and District Disaster Management Authority

After the Hyogo Framework for Action and Sendai Framework, many countries in the world restructured their disaster management authority. They have established disaster management authorities at the district and municipal levels for implementing DRR measures effectively. Different scholars have studied the effectiveness and ineffectiveness of DDMA in implementing DRR in different countries such as India, Bangladesh, Thailand, Nepal, and Vietnam.

In the Coastal communities of Bangladesh, the DDMAs effectively implemented DRR measures. The DDMA prepared disaster risk and vulnerability maps in all unions, organized capacity development sessions, and developed contingency plans with the help of local NGOs and local communities (Uddin et al., 2021). Similarly in Sir Lanka due to DDMA, they have also prepared a disaster hazard and vulnerability map for districts in Sri Lanka (Siriwardana et al., 2018). After establishing DDMA in the Himalayas and Western Ghats of India, significant improvement in implementing DRR has been observed. In these regions awareness sessions and mock drills are regularly arranged by DDMAs and coordination between government and non-government has also improved (Ogra et al., 2021). Different measures of DRR such as the implementation of building codes, land-use policy, and rescue mechanisms have improved in Rampur (Adhikari et al., 2021). According to Nepal et al., (2018) in Nepal before the Disaster Risk Reduction and Management Act 2017, disaster policies were focused only on post-disaster activities. After this act disaster management authorities are established at the provincial and district level. Now disaster policies in Nepal are according to the geography of the province, district, and type of disaster. Moreover, policies are also focused on mitigation and preparedness for disaster.

Indonesia is among those countries in which the DDMA is responsible for the implementation of DRR at the district and city levels. After this step implementation of DRR has improved in Indonesia. Now activities related to DRR have improved. In infrastructure development schemes, educational curricula, and capacity-building sessions have become an important element of DRR (Anantasari et al., 2017). Like Sri Lanka and Indonesia, in the Philippines, the DDMA is responsible for implementing DRR in districts of the Philippines. Alcayna et al., (2016) studied the effectiveness of

DDMA in the implementation of DRR with the help of reviewing peer-reviewed studies, and government and non-government organization reports. They concluded improvement in the implementation of DRR in the Philippines. Now disaster risk and vulnerability have been mapped, increase number of functional Early Warning Systems (EWS), and the introduction of community-based rehabilitation activities.

Talisay is a highly flood-prone city in the Philippines. In Talisay improvement in the implementation of DRR has been observed in the form of timely assistance to the victims, formation of contingency plans, increase in the number of mock drills, and formation of a community-based response team (Herrera Jr, 2021).

Along with the effectiveness of DDMA in implementing DRR, some scholars and researchers also highlight the ineffectiveness of DDMA during the implementation of DRR. The district-level management authority could not implement DRR effectively; Lack of accountability, political interference, and exclusion of local communities in the decision-making process are the main factors (Barua et al., 2021). Municipalities face numerous challenges such as a lack of technical expertise, skilled human resources, financial constraints, and less priority of disaster activities and plans in their planning. Such factors lead to ineffective implementation of DRR (Rana, 2021). In Sri Lanka after the 2004 Indian Ocean tsunami, the Disaster Management Act 2005 was approved and established DDMAs (Secretariat, 2016). Siriwardana et al., (2018) evaluated the DDMA of Sri Lanka and concluded the ineffective implementation of DRR in Sri Lanka due to financial issues. Due to insufficient financial resources, the post-disaster activities were slow and delayed. In DRR public awareness and training sessions are essential components. Fernando et al., (2015) added that training and awareness sessions in Sri Lanka are not conducted properly after the act. The lack of proper coordination, unclear mention of implementing actors, and insufficient financial reasons are the main factors behind the ineffectiveness of the implementation of DRR. Djalante and Thomalla, (2012) pointed out factors behind the ineffectiveness in the implementation of DRR by district and municipal disaster management authorities. The factors included a lack of financial resources, skilled labor, and ineffective communication with federal/state. In addition to this, Herrera Jr, (2021) added that a lack of a proper mechanism for information sharing between the district administration

with the federal and local communities also produces negative impacts during the implementation of DRR. Along with insufficient financial resources and skilled human resources, other factors also contribute to the ineffective implementation of DRR at the district and municipality levels. The lack of political willingness, low priority of DRR in disaster management, lack of modern machinery, and inactive participation of local communities also contribute (Botha et al., 2011). Due to the low priority of DRR in government strategies and financial constraints, international donor organizations provide technical and financial support to the municipality and local government (Titz et al., 2018). According to the landscape of international donors, DRR becomes a barrier to effective implementation of DRR. The international donor organizations neglect local socio-economic settings and advocate generic DRR policies as a result effective implementation of DRR becomes difficult.

Jurilla, (2016) studied the effectiveness of the DDMA in the implementation of DRR in ten municipalities of Iloilo Province in the Philippines. In these municipalities implementation of DRR and DRM has improved, but some factors are barriers to efficient and effective implementation of DRR. These barriers include political interference during the rehabilitation and recovery phase of the disaster, limited budget for municipalities, and lack of proper monitoring and evaluation for disaster preparedness and resource utilization. Furthermore TANWATTANA, (2021) added the top-down approach in government departments during policy formulation, lack of proper institutional channels for engaging local communities in DRR, and overlapping of disaster policies are also barriers to effective implementation of DRR at the regional and district levels.

2.2 Discrete Choice Modelling (DCM) and Willingness to Pay (WTP):

The DCM is used to measure people's preferences about hypothetical goods and services in which different attributes of the good or service at different levels are designed and ask people about their preferences (Hawkins et al., 2010).

In literature, DCM is widely used to determine people's WTP for different events of disasters such as Doherty et al., (2021) documented farmers' willingness to pay for insurance in case of extreme weather events and in the case of Swiss communities

Unterberger and Olschewski, (2021) measured they were willing to pay for better forest management from climate change by using the DCM.

As in DCM different types and levels of attributes of a hypothetical product are used, and for people's WTP for flood insurance, different types of attributes have been discussed in the literature.

Vietnam is included in the top flood-affected countries Reynaud et al., (2018) studied willingness to pay for flood insurance in Vietnam by using the DCM. This study showed people preferred flood health insurance more than flood insurance for houses and agriculture. While according to Akter (2012) in Bangladesh, people preferred agricultural flood insurance over health flood insurance. Brouwer and Schaafsma, (2013) measured willingness to pay for flood by classifying insurance into three groups, home content insurance which included the cost of a damaged home, building insurance which included the cost of damage outside the house and evacuation insurance which included the additional cost when people leave home due to flood. This study showed people were more willing to pay for home content insurance than building and evacuation insurance.

Brouwer and Akter, (2010) surveyed 1200 households in five highly flood-prone areas in Bangladesh and measured their WTP for catastrophic events. About 64% of households showed their WTP for insurance. Most of the households showed a preference for crop insurance. Like other insurance markets, insurance premiums and deductibles play an important role in the acceptability of flood insurance. In this study, WTP for insurance was decreased with increasing insurance premiums. Different other studies also showed a negative relationship between WTP and insurance premiums and deductibles. Wang et al., (2017) documented the WTP of homeowners in North Carolina for flood insurance by using a DCM having different levels of insurance deductible and premium. They concluded with the increase in deductible and premium amounts homeowner's willingness to pay for flood insurance decreases significantly. Similar results were also obtained by Botzen et al., (2013) in the Netherlands. Brouwer and Schaafsma, (2013) and Navrud and Vondolia, (2020) also confirmed the negative relationship between insurance premiums and WTP for flood insurance.

Insurance providers may be government-owned or private entities. Reynaud et al., (2018) concluded in Vietnam people preferred state-owned insurance providers rather than privately owned and a Similar result was also observed in Bangladesh by (Brouwer and Schaafsma, 2013).

In the DCM duration of insurance is other attributes used to measure people's WTP for flood insurance. Wang et al., (2017) used three different duration attributes; 5 years, 10 years, and 15 years of contract, and found people preferred 10 years of insurance more than 5 years and 15 years. Instead of insurance duration Navrud and Vondolia, (2020) used the plot size of farmers as an attribute of the insurance program and concluded farmers having larger sizes of farmers less willing to purchase flood insurance than smaller-size plot owner farmers. Like the duration of insurance, the occurrence of flood is also used as an attribute in the DCM of flood insurance. Navrud and Vondolia, (2020) used six, eight, and ten years for flood occurrence and found that farmers were more willing to pay insurance for six years as compared to eight and ten years.

In DCM along with attributes of hypothetical products, attributes of decision-makers are also measured to show people WTP for the hypothetical products. Botzen and van den Bergh, (2012) measured the demographic features of the decision-maker of flood insurance in the Netherlands. According to this study, WTP for flood insurance was higher in less flood-prone and unprotected areas against flood than in high flood-prone and protected areas. During measuring WTP for flood insurance in the USA, Wang et al., (2017) concluded a positive relationship between WTP of flood insurance with the location of decision-makers near to coastal areas and income level while the negative relationship with the age of household owner. Doherty et al., (2021) surveyed 270 farmers in Ireland and measured the association between various demographic attributes of farmers with their WTP for flood insurance. In this study farms of the farmers were divided into five farm systems (dairy, cattle, sheep, mixed, and tillage), and there were no significant differences between WTP and type of farms. The location was divided into Border, West Ireland, South Ireland, and Midlands, and more WTP for flood insurance was concluded in West, Midlands, and Border Ireland than in South

Ireland. WTP was found negatively significant with the age of farmers while insignificant with farmers' gender, and educational level,

2.3 Flood Insurance and Pakistan

After the devastating 2010 floods in Pakistan, researchers like (Abbas et al., 2015; Arshad and Shafi, 2010; Fahad and Jing, 2018; Turner et al., 2014) studied WTP for flood insurance In Pakistan. Abbas et al., (2015) studied WTP for flood insurance in five districts of Punjab. The districts were Mainwali, Dera Ghazi Khan, Jhang, Muzaffargarh, and Layyah. They used the contingent valuation method and concluded that WTP for flood insurance depends on many factors such as education level, income level, and land ownership. In Pakistan agriculture sector is often affected by floods. In addition to, education, income, and land ownership, WTP for flood insurance in Khyber Pakhtunkhwa (KPK) is also influenced by access to credit and the distance between agricultural land and river (Fahad and Jing, 2018). According to the Arshad and Shafi, (2010) acceptability of flood crop insurance in Pakistan significantly depended upon the insurance premiums and income of the farmers. The relationship between WTP for flood insurance is negatively associated with insurance premiums and positively with the level of income.

The WTP for flood insurance also depends upon the past flood experiences of the people. In Pakistan, past flood experiences significantly affect the acceptability of flood insurance (Turner et al., 2014). They collected data from 384 respondents of which half (192) were flood affectees of the 2010 flood and half were not non-flood affectees. The flood-affected respondents showed more willingness to purchase flood insurance than non-flood affectees.

2.4 Literature Gap

In Pakistan, (Abbas et al., 2015; Arshad and Shafi, 2010; Fahad and Jing, 2018) measured willingness to pay for flood insurance. My study is different from these studies in two ways. First, these studies measured WTP for flood insurance only for farmers, secondly, they used the Contingent Valuation Method (CVM). This study included local communities of District Skardu irrespective of their occupation, and the econometric model is the Discrete Choice Model (DCM).

For a hypothetical market scenario, CVM and DCM are widely used but CVM has some biases that lead to over or under-estimation. In the case of DCM, many attributes and their levels are presented to the respondent while CVM restricts the respondent to a single choice. The option of no choice in DCM avoids force selection on the respondents and also avoids protest problems as respondents indirectly ask about monetary valuation (Ali, 2022). These features make DCM a true representation of market scenarios and avoid over or under-estimation of CVM.

Shah and Rana (2023) measured institutional barriers faced by GBDMA in the implementation of disaster management and DRR measures in the Gilgit district. However, this study is designed to explore barriers and effectiveness of disaster management authority in implementing DRR for District Skardu, division headquarters of Baltistan division.

2.5 Theoretical Framework

The study is based on the "Extended Protection Motivation Theory" (PMT).

2.5.1 Tradition Protection Motivation Theory (PMT)

This theory was developed by Rogers (1983) to study psychological factors in human behaviors and attitudes. With time this theory has started to study different socio-economic and environmental concerns such as flood management, political issues, and climate changes (Milne et al., 2000). Now this theory is widely used to study different natural hazards (Grothmann and Reusswig, 2006).

2.5.2 Component of PMT

There are two components of PMT, Threat appraisal and Coping appraisal. The threat appraisal means the individual's perception of the probability of happening and the consequences of disaster events. The coping appraisal means the individual degree of belief about the capacity to reduce risk and losses (Oakley et al., 2020). In PMT, threat appraisal depends upon two factors: perceived probability and perceived consequences. The perceived probability means an individual's belief about the intensity of natural hazard events while perceived consequences mean the possibility of being affected by natural hazard events (Ezati Rad et al., 2021). The coping appraisal depends upon three parameters; response efficacy, self-efficacy, and response cost. The individual's belief about the effectiveness of protective measures is called response

efficacy while any individual's belief in his/her ability to take specific measures is called self-efficacy. Response cost stands for the individual estimation cost of taking protective measures (Bubeck, 2012).

According to PMT, people take protective or non-protective measures for risk. When an individual evaluates high threat appraisal of risk and high coping appraisal of measure of risk management, then the individual will take necessary protective measures (Twerefou et al., 2019). By using PMT, many researchers evaluate people's and community's WTP for different natural hazard events. For example Entorf and Jensen (2020) used this theory to analyze household behaviors to take precautionary measures in flood-prone areas in Germany while Roder et al. (2019) studied the willingness to pay off people in flood-prone areas of Italy by using PMT.

2.5.3 Extended PMT

The extended form of PMT was developed by Poussin et al., (2014). According to them, besides threat appraisal and coping appraisal, different other factors also influence people's behavior to take necessary steps for disaster management and transfer disaster risks. Different socio-economic characteristics, flood experiences, and local flood management policies significantly influence people's willingness to take protective measures. Twerefou et al. (2019) used the extended form of PTM to analyze households in Ghana to study their flood management strategies. In the Figure 7, the conceptual framework of the study is explained

Figure 7: **Conceptual Framework of the Study**
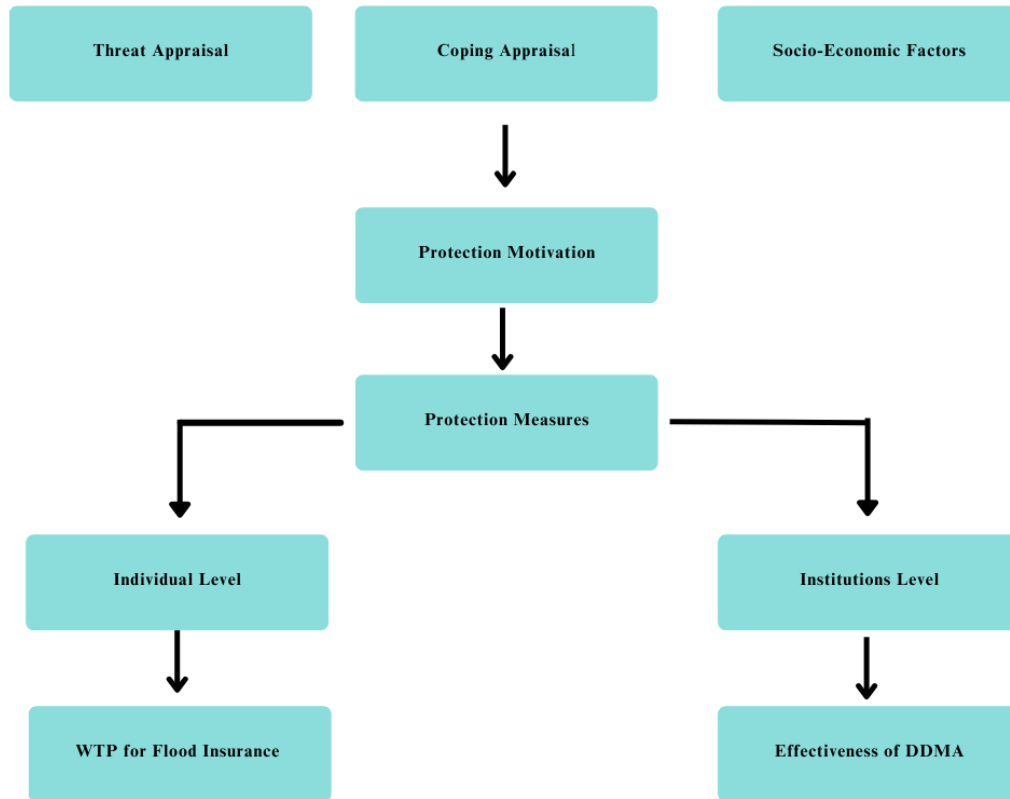
(Source Author)

This study employs the extended form of the Protection Motivation Theory. Due to climate change frequency and intensity of extreme weather-related events have increased because of which threat appraisal also increases. People's knowledge about future flood events, the probability of occurrence, and their possible impacts lead people to invest in resilient measures (Knuth et al., 2014; Thistlethwaite et al., 2018). A high level of coping appraisal will enhance people's motivation to take protection measures to reduce the risk of disaster and (Bamberg et al., 2017). In the future climate change is projected to increase and the insurance market for floods is a better mechanism for transferring its risks and compensating losses (Aerts and Botzen, 2011).

Chapter 3
METHODOLOGY

This chapter is about the methodology applied to the study. This chapter begins by explaining the research design of this study, which is followed by a description of the units for data collection, methods of data collection, sampling techniques, and tools used for analyzing collected data. In the last portion, the locale of the study area is explained with the help of the map.

3.1 Research Design

The research design of the study is mixed-methods research. In mixed methods, both quantitative and qualitative research methods are used for data collection and analysis Morse, (2016). The qualitative research method is applied to an in-depth analysis of the District Skardu Disaster Management Authority's effectiveness in the implementation of DRR. The quantitative research method is employed to determine the willingness to pay of the local communities for flood insurance.

3.2 Unit of Data Collections (UDCs)

There are two UDCs in this study: UDC-1 and UDC-2 presented in Appendix 4. The UDC-1 is used to explore the effectiveness of Disaster Management Authority Skardu in the implementation of DRR. The UDCs-1 are government departments, academia, and non-government agencies. The government agencies are selected according to the GBDMA Act 2017 and GB Finance Act 2023, in which it is clearly mentioned that along with GBDMA, other government agencies are also responsible for disaster management and DRR in GB. The government agencies interviewed were the Gilgit Baltistan Disaster Management Authority (GBDMA), the District administration of Skardu district, the Skardu Development Authority (SDA), the Department of Local Government and Rural Development Gilgit Baltistan (LG&RD), Agriculture Department District Skardu, Department of Water Management District Skardu, Gilgit Baltistan Public Works Department (GB-PWD), Directorate of Planning and Development Baltistan Division (P&D), Public Health Engineering District Skardu (PHE), Recuse-1122 District Skardu, and Gilgit Baltistan Rural Support Program

(GBRSP). For the academic perspective, point view of researchers and faculty members of the University of Baltistan Skardu (UoB) were interviewed while Aga Khan Rural Support Programs (AKRSP) and United Nations for Development Program (UNDP) were non-government agencies interviewed as they are actively involved in different climate and disaster-related initiatives in GB and District Skardu.

The UDC-2 is used to explore WTP for flood insurance. Flood insurance helps in compensation for damages and losses resulting from floods. All local communities of district Skardu have not experienced floods and their consequences. Thus, to determine WTP for flood insurance, the UDC-2 consisted of only past flood-affected communities of District Skardu.

3.3 Data Collection

In this study, primary data is collected. With the help of Semi-Structured/ face-to-face interviews data is collected from the UDC-1 to study the effectiveness of the District Disaster Management Authority of Skardu in implementing DRR in District Skardu. The data about the WTP for flood insurance from flood-affected communities is collected with the help of survey questionnaires and choice cards.

3.4 Sampling

The non-probability sampling technique is used for the data collection. The non-probability sampling techniques are further divided into different sub-groups such as purposive sampling, snowball sampling, and convenience sampling. However, in this study, the purposive and convenience sampling methods of non-probability sampling techniques are used.

3.4.1 Purposive Sampling

Purposive sampling is employed for data collection from UDC-1. As the UDC-1 are government officials, academia, and NGOs they have a deep understanding of the implementation of DRR in District Skardu. They are well-informed about the effectiveness of DRR in Skardu. In purposive sampling availability and willingness of sample elements also a play significant role. Since the availability of the UDC-1 is not deterministic, based on these two points purposive sampling is used for UDC-1.

3.4.2 Convenience Sampling

Convenience sampling is applied for data collection from UDC-2. In GB most of the areas are located at a high altitude and geographical access is not easy. Since the UDC-2 is past flood-effected communities of District Skardu, so with the help of convenience sampling data related to willingness to pay for flood insurance are collected easily.

3.5 Data Analysis

Two different tools are used for data analysis in this study. To evaluate the effectiveness of DRR implementation in the District of Skardu, a thematic analysis is used while WTP for flood insurance is calculated with the help of discrete choice modeling.

3.5.1 Thematic Analysis

In qualitative research, thematic analysis and content analysis are the common methods of data analysis that use non-numerical data to achieve meaningful results (Neuendorf, 2018). Vaismoradi et al., (2016) highlighted the difference between content analysis and thematic analysis. According to them, both methods are involved in identifying themes, but in the case of content analysis themes and categories are predefined while in the case of thematic analysis themes come from the data. Bryman (2016) defines thematic analysis as the discovery of key themes, and concepts. This method is not limited only to the summarization of data but also includes meaningful analysis and interpretation of qualitative data.

During thematic analysis, after the collection of qualitative data review of transcripts helps in developing a set of themes and sub-themes based on which data will be analyzed, interpreted, and organized (Khan, 2022). Bryman (2016) developed five steps of the framework of thematic analysis

1. Review of collected data (Familiarizing)
2. Identification of themes, and subthemes (Thematic framework)
3. Developing of codes against themes and subthemes (Indexing)
4. Summarization of data
5. Result and interpretation of data

In this study, the thematic analysis is used to explore the effectiveness of DRR implementation in District Skardu. Thematic analysis is employed for in-depth analysis of the effectiveness of DRR and also barriers to implementing effective DRR in District Skardu.

Along with thematic analysis, content analysis is also a method for analyzing qualitative data. The thematic analysis method is more subjective, and themes are not predefined, so details and in-depth analysis are possible. So, in this thematic analysis is preferred over content analysis for details and in-depth analysis of DDMA District Skardu in implementing DRR. To study institutional barriers faced by GBDMA in the implementation of disaster management and DRR measures in the Gilgit district (Shah and Rana, 2023) also preferred thematic analysis over content analysis.

3.5.2 Discrete Choice Modelling (DCM)

The DCM is a model of the stated preference method used to determine WTP for a hypothetical market. In the DCM, different attributes of the good or service at different levels are designed, and ask people about their WTP for the good or service (Hawkins et al., 2010)

Different researchers and scholars have used the DCM to measure people's willingness to pay for hypothetical markets especially in case of disaster events as Doherty et al., (2021) measured farmers' willingness to pay for insurance in the case of extreme weather events and in the case of Swiss communities Unterberger and Olschewski (2021) showed they were willing to pay for better forest management from climate change by using the DCM.

The methodology of DCM is derived from the combination of Lancaster's Consumer choice and Random Utility Theory (RUT). According to Lancaster (1966) consumers gain utility from the characteristics of the goods or services rather than directly from the goods or services. The Lancaster's consumer choice model assumes that the consumption of goods is an activity in which goods are input and their characteristics are output and preferences of consumers (outcomes) come from a combination of different attributes (output) that becomes relevant to the DCM by putting various attribute levels for each attribute of a hypothetical good (Lam, 2023).

According to RUT, the preferences and choices of individuals are not deterministic, they change with changes of internal and external factors. Individuals are rational and want to maximize their utility level and in the case of given alternatives, they would select the one that would give them maximum satisfaction (Manski, 2001).

On the basis of Lancaster's Consumer and Random Utility Theory, the respondent's response about choice can be written as

$$Uij = Vij + \varepsilon ij = \beta k \, Xij + \varepsilon ij$$

Here i represents individual, j represents choice from the choice set which gives maximum utility, Vij measurable part of the utility, εij unobservable influences on choice, and β vector association of attributes and individuals.

In choice modeling the conditional and multinominal logistic models are used to determine the choice among the alternative of the hypothetical product. The conditional logistic model focuses on the characteristics of the alternatives rather than individual characteristics to choose among the alternatives (Hoffman and Duncan, 1988). The mathematical representation of the conditional logistic model of this study is as follows,

$$Uij \, (\textbf{Flood Insurance})$$
$$= \beta o + \textbf{Insurance Cover} \, (\beta 1) + \textbf{Premium} \, (\beta 2)$$
$$+ \textbf{Insurance Provider} + \varepsilon ij$$

In this study, the conditional logistic model for the WTP for flood insurance has a linear function with Insurance Cover, Premium, and provider.

The multinomial logistic model is used to determine individual characteristics that influence the acceptability of the hypothetical product Hoffman and Duncan, (1988). The mathematical form of the multinomial logistic model is as follows,

$$Uij \, (\textbf{Flood Insurance})$$
$$= \beta o + \beta 1 \, \textbf{Education}$$
$$+ \beta 2 \, \textbf{Earner number} + \beta 3 \, \textbf{location} + \varepsilon ij$$

This model shows the demographic features of the decision-makers as the function of flood insurance. In this study education level, earner numbers in the family, and location of the house of the decision-makers are included to explore the impacts of socio-economic factors on the WTP for flood insurance. In this study, there are two models for the multinomial logistic model are used. In the first model, insurance policy

one is related to policy three while in the second model insurance policy two is related to policy three. So, insurance policy three (status quo) is the referent category for the multinominal logistic model.

The methodology of DCM consists of three steps and this study also ensures the completion of all three steps before data collection and fieldwork. The first step is the selection of the appropriate attributes and attributes level. After the literature review, different attributes and attribute levels were selected. However, some of them were not according to the damages and demography of District Skardu. In order to select them according to District Skardu expert interviews were conducted with different insurance companies in District Skardu, climate change experts, government officials, and also from flood-affected communities. Furthermore, different official documents such as the GB disaster compensation policy and GB Finance Act 2023 were also analyzed to choose appropriate attribute levels. After reviewing literature, government documents, and experts interview three attributes were selected that are economically feasible and relevant to flood damages in Gilgit Baltistan and District Skardu. Table 2shows selected attributes and attribute levels for this study.

Table 2 Attributes and Attributes level

Attributes	Levels		
Insurance Coverage (PKR)	200,000	400,000	600,000
Insurance Premium (PKR)	4000	7000	10,000
Provider	Government	Private	

The second step in the methodology of the DCM is the experimental design of the study. In this step, choice cards are developed according to the attributes and attributes level. The factorial and partial factorial analysis are generally applied to develop choice cards. In this step, partial factorial analysis was performed to narrow down choice cards so that respondents could fill the survey in a reasonable time and collect data on time. After partial factorial analysis, eighteen choice cards were developed. Each choice card consisted of three options. In the first two options, different combinations of attributes and attribute levels were mentioned while the third option was status quo (none of

them). In the Figure 8 sample choice card is presented while all choice cards are presented in the Appendix 3

Figure 8 Sample Choice Card

In the last step, the appropriate econometric models are applied to get the desired objective and results. In literature, conditional logistic models and multinomial logistic models are applied to achieve desired outcomes. In this study, the conditional logistic model is applied to check the effect of attributes and attribute levels on respondent's WTP for flood insurance. The multinomial logistic model is applied to find out the effects of the socioeconomic factors on the respondent's WTP for flood insurance.

Description of Locale

Gilgit Baltistan is located in the north of Pakistan and is covered with 72,921 km^2 of area which is divided into three divisions, Gilgit, Baltistan, and Diamer. Each division is further classified into districts. The Baltistan division consists of districts Skardu, Ghanche, Shigar, and Kharmang as shown in Figure 9. This study has covered District Skardu of the Baltistan division.

Figure 9: **Map of Baltistan**
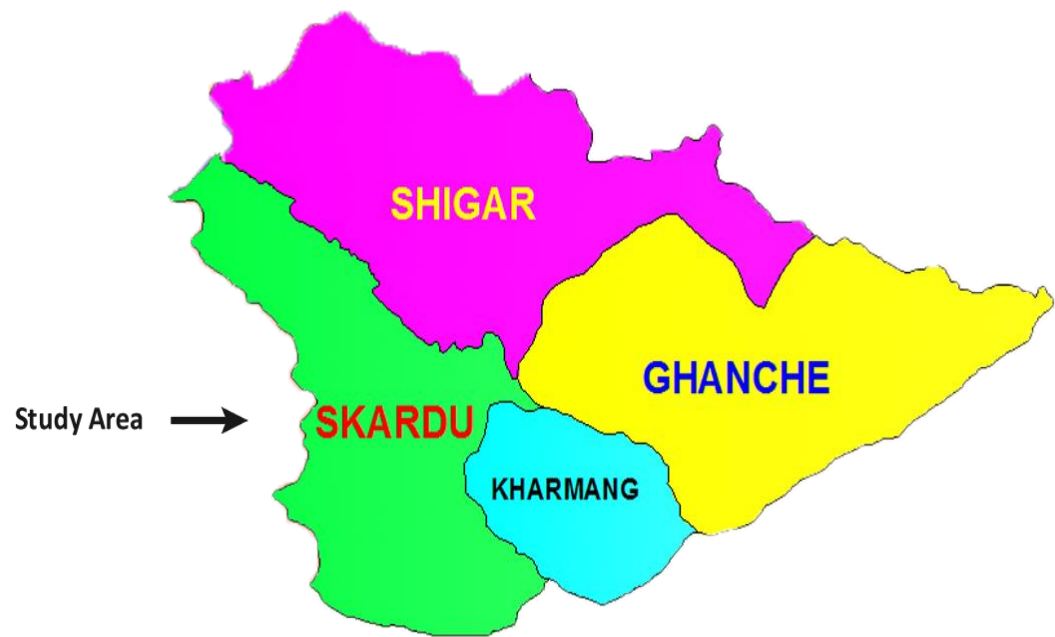
Chapter 4
RESULT AND DISCUSSION

This chapter explains and interpretation and results of the data. In the first part of this chapter, the description of the respondents is explained. After this, the results of the thematic analysis are discussed. With the help of the thematic analysis effectiveness of the DDMA of District Skardu is described according to the themes of the thematic analysis.

The second portion of this chapter discusses WTP for flood insurance to compensate flood damages. Before explaining WTP for flood insurance, the demographic characteristics of the respondents and data are explained. After this, results of the conditional logistic model and multinominal logistic model are presented to show the effects of the attributes, their level, and demographic characteristics of the respondents on the WTP to flood insurance.

4.1 Thematic Analysis

To evaluate the effectiveness of the implementation of DRR in district Skardu, key informant interviews were conducted with eighteen respondents from different government agencies, academia, and non-government agencies. The government agencies were the District Disaster Management Authority, Skardu Development Authority, Department of Local Govt. and Rural Development, Recuse1122, Department of Public Health Engineering, Gilgit Baltistan Public Works Department, Directorate of Planning and Development Baltistan Division, and Department of Water Management. Faculty members and researchers from the University of Baltistan were selected for the perception of the academic. Along with the government agencies, different non-government agencies are also involved in disaster-related activities. On a large scale, disaster-related activities are carried out by two non-government agencies: the Agha Khan Foundation and the United Nations. Agha Khan Rural Support Program was interviewed as a representative of the Agha Khan Foundation and United Nations Development Programs for the United Nations. The description of the respondents is explained in the Table 3

Table 3 **Description of Respondents**

Organization	Organization form	Number of Respondents
District Skardu Disaster Management Authority	Government	02
Skardu Development Authority	Government	02
Skardu District Administration	Government	02
Department of Local Govt. and Rural Development	Government	01
University of Baltistan Skardu	Academia	02
Recuse1122	Government	01
United Nations Development Program	Non-Government	01
Gilgit Baltistan Rural Support Program	Government	01
Aga Khan Rural Support Programs	Non- Government	01
Department of Public Health Engineering	Government	01
Gilgit Baltistan Public Works Department	Government	01
Department of Agriculture	Government	01
Directorate of Planning and Development Baltistan	Government	01
Department of Water Management	Government	01

In thematic analysis after the interview and collection of data, the familiarizing process is applied to review collected data. After multiple reviews of data, different themes emerged. When themes emerged, they were classified in theme number as described in Figure 10. In this study, after multiple reviews of collected data, eight themes are identified. The eight themes identified after thematic analysis are, Disaster Risk Identification and Assessment, Disaster Vulnerability Assessment, Disaster Preparedness Planning, Early Warning Systems, Community Engagement and Participation, Coordination and Collaboration, Response and Recovery, and Resources Allocation.
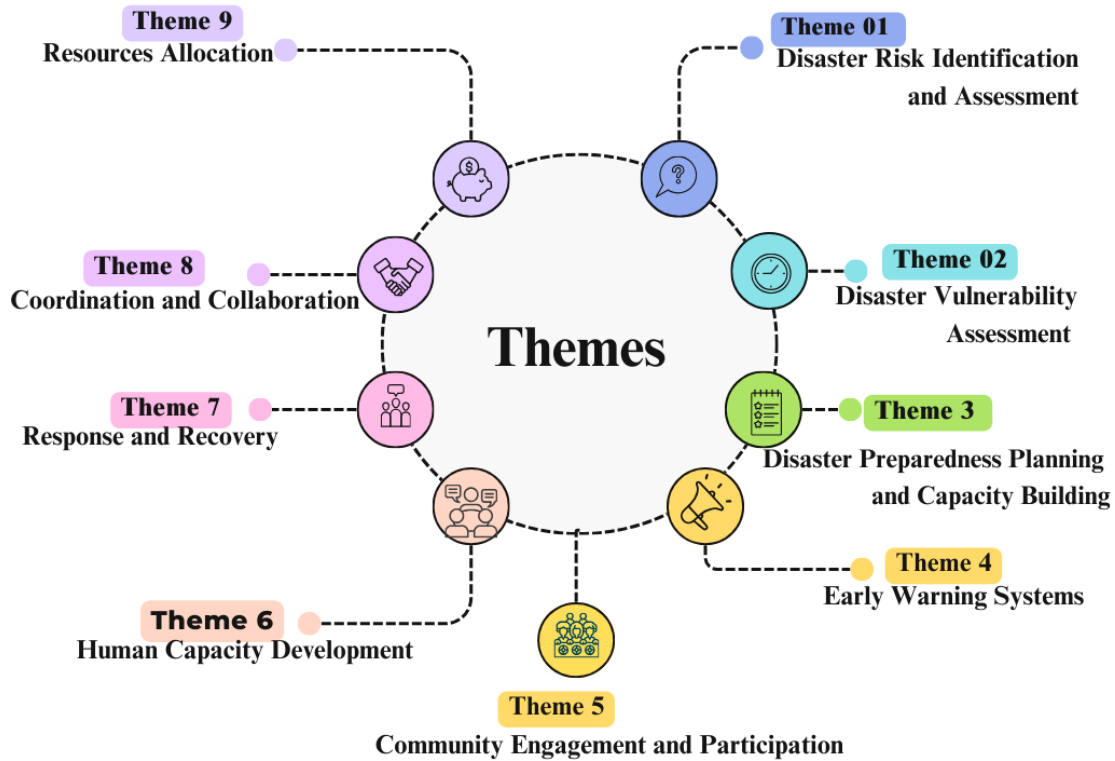
4.2 Discussion of the Themes

Detailed discussion about the themes of thematic analysis are as follows,

4.2.1Disaster Risk Assessment and Identification

Every region needs a proper risk assessment and identification framework according to the disaster events, topography, and local setting of the region (Nguyen et al., 2019). Currently, the District Skardu is facing various types of disasters such as flash floods, GLOF, land Sliding, Earthquakes, and Soil Erosion. These different types of disasters highlight proper disaster risk assessment and identification in District Skardu for effective implementation of DRR in District Skardu.

In GB, the GBDMA is primely responsible for proper disaster risk assessment and identification. The GBDMA follows historical data and trends for disaster risk assessment and identification in GB and Skardu.

"…. *Currently, we have no proper mechanism for disaster risk assessment and identification. We assess disaster risk based on historical data and district administration field information. For proper risk assessment, we have approved a project named Multi Hazards Vulnerability and Risk Assessment (MHVRA) for the whole GB, which will be advertised soon"* (Respondent-1)

Due to rapid changes in average temperature frequency and the occurrence of disasters, events are also changed. Without a proper research-based and systematic mechanism disaster risk identification and assessment cannot be efficient. However, different government departments including GBDMA have proposed different initiatives for proper disaster risk assessment and identification such as MHVRA and masterplan of District Skardu. With the help of MHVRA disasters can be assessed and identified scientifically up to the Union Council level. The masterplan of District Skardu has been submitted but has not yet been approved by the GB cabinet, and assembly. In the masterplan climate and disaster-prone areas of the district, Skardu has identified. With the approval of the master plan, DRR can be implemented in better ways according to the type of disasters in different parts of District Skardu.

In this study, all respondents point out the challenges of the lack of proper disaster assessment and identification in GB and District Skardu. According to them, financial constraints, social issues, lack of technical staff, and lack of human resources are the main factors for the lack of proper disaster risk assessment and identification in District Skardu.

"In GB, Gilgit Baltistan Disaster Management Authority has been established but failed to develop comprehensive and research-based disaster risk assessments report due to inefficiency in the governance structure of GB, and lack of sufficient human and financial resources" (Respondent-10)

4.2.2 Disaster Vulnerability Assessment

Disaster Vulnerability Assessment is a crucial element in implementing DRR measures. The disaster vulnerability assessment includes different socio-cultural elements and helps in developing a holistic framework to prevent, adapt, and mitigate disasters (González et al., 2017).

As District Skardu is highly vulnerable to different disaster events such as Flash floods, GLOF, Rockfalls, Soil Erosion, Land sliding, and Earthquakes. So, it has become necessary for disaster vulnerability assessments of community, infrastructure, and ecosystem. But like disaster risk assessments and identification, disaster vulnerability assessment is not integrated and does not follow scientific approaches in GB. In the GBDMA Act 2017, it is mentioned along with GBDMA other government agencies such as the Gilgit Baltistan Public Works Department, and the Department of Local Govt. and Rural Development Gilgit Baltistan are responsible for disaster vulnerability of the ecosystem and infrastructure of GB. However, due to weak coordination between them in rare cases, the vulnerability assessment is performed, which is based on historical trends of disaster.

In this study, respondents mentioned factors that contributed to the disaster vulnerability of GB and District Skardu, and also the lack of proper, research and evidence-based disaster vulnerability assessment analysis in GB. According to the respondents, uncontrolled migration, unplanned use of land, high influx of tourists, ineffective implementation of building codes, rapid and unpattern commercial activities, and over-consumption of natural resources are the main factors that contribute to the disaster vulnerability of GB and District Skardu.

Different socio-economic factors are contributing to the lack of proper disaster vulnerability assessment of District Skardu. Lack of human resources, far-flung geographical location, least priority of DRR in government procedure, and lack of effective coordination between government and non-government are some highlighted reasons for the lack of disaster vulnerability assessment in Gb and District Skardu.

4.2.3 Disaster Plan Preparedness

In the DRR measure, disaster plan preparedness is the pre-disaster phase that consists of pre-disaster interventions, preventative and precautionary measures (Parvin et al. 2013).

Now the world has developed integrated disaster preparedness plans that cover pre-disaster, during-disaster, and post-disaster activities. In GB, the GBDMA is directly involved in disaster plan preparedness while other government departments provide technical support to the GBDMA. The pre-disaster preparedness plan in GB and Skardu

is limited to formulating the two contingency plans. Every year the Monsoon Contingency Plan and Winter Contingency Plan are formulated. However, due to the lack of proper disaster risk and vulnerability assessment, such plans are revised annually but limited to changes in date and signature.

During the disaster, timely provision of food items, medicine, and shelter to the disaster victims are important elements. For the timely provision of food items, the DDMA has signed a MoU with Utility Stores Cooperation. While in case of non-availability of food items in utility stories, they can buy food items from the market as soon as disaster emergency funds are released by the government of GB and District administration. But this whole mechanism is very high time-consuming due to the top-bottom approach. After the approval of the Director General of GBDMA utility stories cooperation provide necessary food items to the DDMA. In addition to this, the food department of GB is responsible for food stocks for 3-4 months in hard and inaccessible parts of the District Skardu. But, due to financial constraints, enough food stock always remains an issue in district Skardu.

In GB and District Skardu, except for the two contingency plans, no other disaster-related plans or policies. The GBDMA and DDMA of District Skardu still failed to formulate comprehensive disaster plans for GB and District Skardu respectively according to the type of disasters such as GLOF, Earthquakes, and Flashfloods and also the geography of different regions of GB and District Skardu.

Numerous socio-economic factors contributed to the lack of a comprehensive disaster preparedness plan in GB and District Skardu. Among them, lack of real-time data, lack of skilled human resources, lack of weather updating station, financial constraints, lack of law land encroachment policy, and lack of proper coordination are the main challenges for the formulation of a comprehensive disaster preparedness plan in District Skardu.

4.2.4 Early Warning Systems

For effective implementation of DRR, timely information dissemination, and forecasting about disasters to vulnerable communities are necessary to minimize the impacts of disasters. With the help of the Early Warning System (EWS) forecasting and information sharing about disaster has become possible. The disaster management

authorities are responsible for the installation of EWS in climate and disaster-vulnerable areas. In District Skardu, there is no functional EWS. The first system was installed in Basho Valley of District Skardu with the help of UNDP, but yet not functional.

There are many socio-economic barriers in the implementation of EWS in disaster-prone areas of GB and District Skardu. Installation of EWS is a high-cost process. The GBDMA has a limited budget for mitigation and adaptation activities as a result installation of EWS becomes difficult. The first EWS in Basho Valley of District Skardu was installed by UNDP. In GB, during the installation of EWS, the community provides an installation space without any compensation for space. In the GB and District Skardu community is also resistant to providing space due to a lack of compensation. So lack of financial resources, community resistance, lack of proper risk assessment mechanisms, and inaccessible geographical locations are the main barriers to the installation of EWS in GB and District Skardu.

4.2.5 Local Community Engagement

Local Community Engagement for DRR means local communities are fully aware of disasters, associated risks of disaster, and are well-trained to take necessary steps to minimize disasters and their risks(Trogrlić et al., 2022)

Like different government and non-government organizations, local communities are paramount stakeholders in implementing DRR effectively. In GB and District Skardu, local community engagement and participation in DRR is limited only to arranging awareness sessions. Both government and non-government organizations are actively involved with local communities to raise awareness about disaster and DRR. Awareness sessions are arranged at the village level, tehsil level, and in different educational institutions.

Information sharing with local communities is another parameter to study local community engagement and participation in the implementation of any intervention. In GB and District Skardu, there are two mechanisms of information sharing and engaging with local communities to implement DRR. When DDMA receives any advisory or alert about a disaster they share information with the Assistant Commissioner's office. The Assistant Commissioner's office is the command-and-control office for disaster,

and they are directly linked with Nambardar of villages and imams of mosques. With the help of Nambardars and imams information is disseminated. The second way is the help of the Local Community Disaster Management Committee (LCDMC). In some parts of the District, Skardu LCDMA is established by non-government organizations. This committee is a registered and legal body that works closely with district administration and DDMA. These two mechanisms are also used to arrange disaster awareness and training sessions in different parts of District Skardu.

In the case of Skardu non-government agencies are more active than government agencies in engaging local communities for the proper implementation of DRR. In different disaster-prone areas of District Skardu, the INGOs have established a community hall known as "Safe Heaven". With the help of Safe Heaven, different human capacity development for DRR is arranged by both government and non-government agencies.

"...Safe heavens are established for direct engagement with local communities"
Respondent-8

For successful implementation of any measures, it is necessary to direct the involvement of the local communities in the policy formation stage and consider their perceptive. Like other parts of GB, the DDMA of District Skardu formed two contingency plans for District Skardu, but local communities don't have any stake during the policy formation stage. During disaster emergencies, the Deputy Commission calls for meetings for emergency response and activities, and except for local communities, all government and non-government attend the meeting.

In GB and District Skardu, disaster information and alert sharing and awareness sessions with local communities are arranged in a better way comparatively, however, inputs of local communities are ignored during policy formation. Both government and non-government agencies are facing numerous challenges in engaging local communities for effective implementation of DRR in District Skardu. In District Skardu, the main challenges include land disputes, lack of road infrastructure, people's religious beliefs, lack of awareness, and disputes of community with their nearby communities for local community engagement and participation to implement DRR.

"… sometimes community resist to participate in DRR due to their religious beliefs"
Respondent-5

4.2.6 Human Capacity Development

In the effective implementation of DRR, human capacity development programs are necessary. Along with local communities, the human resources of the DRR implementing agencies should be well-trained and skillful. Human capacity development programs are designed to enhance capability and strengthen human resource (Dewa et al., 2021).

In the DRR, human capacity development programs are pre-disaster activities. In GB and District Skardu, pre-disaster activities are limited to formulating contingency plans. Sometimes human capacity development sessions are arranged, but mostly by non-government agencies. In GB and Skardu due to a lack of proper refresher and capacity development sessions, human resources in governmental departments are not well-equipped to manage disaster risks and implement DRR effectively.

Even the limited activities on human capacity development are not achieving targeted goals and objectives and as a result, DRR measures are not effectively implemented in the GB and District Skardu. In this study, respondents highlighted various factors that contributed to the failure of such sessions to achieve their goals and objectives. In GB and District Skardu, lack of proper refreshment courses, gender segregation, lack of specialized trainers, and theoretical sessions are the main highlighted socio-economic factors in the failure of human capacity development sessions to achieve the goals and objectives.

".. most of cases such sessions are limited to photo sessions. In a session of 40 minutes to one hour, no one can develop their capacity level" Respondent-11

4.2.7 Coordination and Collaboration

Globally many countries have adopted decentralized disaster management mechanisms as a result both horizontal and vertical coordination and collaboration are important elements in implementing DRR (Moises et al., 2024). In Pakistan, disaster management authorities are also highly decentralized, now authorities are working at the district level. Without proper coordination and collaboration with federal agencies, provincial agencies, and local communities, DDMA cannot work in the sole.

With federal-level agencies such as NDMA, and the Federal Flood Commission, the GBDMA is coordinating and collaborating with them. While in the case of provincial agencies, district administration, and NGOs, the DDMA of District Skardu is responsible for coordination and collaboration.

The coordination and collaboration of DDMA with other agencies are not effective. Such ineffectiveness produces negative effects on the implementation of DRR in District Skardu. There are many factors associated with weak coordination and collaboration. Government procedures and practices are among the top factors. In District Skardu, all government departments follow the top-bottom approach, and this approach consumes too much time. Furthermore, slow response rate, red-tapping, and sludge further weaken the coordination and collaboration. In Skardu, information with other government agencies is shared by file culture which also leads to ineffective coordination and collaboration.

"Traditional mode of information sharing is a barrier for better coordination and collaboration" Respondent-10

4.2.8 Response and Recovery

Response and recovery are the during and post-disaster phases of DRR. When DRR is implemented properly and effectively, response and recovery activities of disaster become easy and carried out smoothly.

In GB and District Skardu, there are two mechanisms for proper response and recovery activities. In the case of damages such as infrastructure damage, power disruption, and water channel the DDMA consults with line departments such as the GB-PWD, and PHE and they initiate disaster response and recovery activities. However, the lack of a proper disaster preparedness plan and weak coordination between government agency response activities have become a timing-consuming, and delayed process. On average it takes 24-48 hours, but in some cases, it also takes more than 48 hours to initiate response and recovery activities.

In the case of any casualties, injuries, and house damage the district administration and DDMA compensate them according to the compensation policy of the government of GB. During the compensation of victims, timely release of funds and land disputes among victims have become the main issues faced by the DDMA.

In addition to the lack of a disaster preparedness plan, weak coordination, and financial constraints, many other factors are also producing negative effects on response and recovery activities and the effective implementation of DRR. Those factors are lack of accessible road infrastructure, lack of modern machinery, political interest, nepotism, and disputes among local communities are key challenges for quick disaster response and recovery. In some cases, community resistance and post-disaster land grasping by victims are also barriers to timely resettlement and recovery.

> *"Politicians always pressurized to start response and recovery activities according to their own wish and their voter majority area"* Respondent-11

4.2.9 Resources Allocation

Sufficient resources such as financial resources, human resources, and capital are essential elements to implement DRR measures. In the case of financial resources, the government of Pakistan has allocated a specific amount for both mitigation and adaptation measures. However, the allocated amount is limited for the effective implementation of DRR.

> *"We have a limited amount of financial budget. We need to care about their spending because if we use them for mitigation, then in case of any disaster we face serious financial issues for recovery and rehabilitation activities*" Respondent-1

In the annual budget of GB, for DRR and DRM a specific amount is allocated as non-development expenditure. But, the provision of funds follows the old colonial system. In GB the disaster emergency funds are released according to the GB Finance Act 2023. In this act, the GBDMA cannot release emergency funds. In Table 4 responsible authorities and provision of funds are presented.

Table 4: **Provision of Emergency Fund in GB**

Authority	Provision of funds (Rs. Million)
Deputy Commissioner of District	Up to 5,000
Commissioner of Division	5,000 to10,000
Chief Secretary GB	10,000 to 20,000
Chief Minister GB	Above 20,000

(Source: GB Finance Act 2023)

For approval of emergency funds, an emergency meeting is arranged, and all concerned government department heads are called for a meeting. However, weak coordination between government agencies, delays in governmental procedures, lack of transparency, and political interest also hinder in the timely release of emergency funds.

In the case of human resources. The lack of sufficient and well-trained human resources is also a barrier to the effective implementation of DRR in District Skardu. The Assistant Director of DDMA of District Skardu has additional charge of District Shigar. In the Baltistan division, there are four districts but currently, only two assistant directors are appointed. In District Skardu along with the assistant director only two clerical staff are working without any proper office set-up. The lack of well-trained and qualified human resources hinders for effectiveness of DDMA in District Skardu. Other line government agencies have a sufficient number of human resources, but they are well-trained.

In addition to the lack of well-trained human resources lack of sufficient and modern machinery also intensified the in-effectivities of DDMA District Skardu in the implementation of DRR. The DDMA has a limited number of machinery facilities for managing disasters and DRR.

Table 5 **Number and Type of Machinery in District Skardu**

Type of machinery	Number
Wheel Dozer	2
Road Roller	4
Tractor MF-385	5
Excavator	2

(Sources GBDMA)

The thematic analysis identifies weak disaster institutional setup in District Skardu. Due to the weak institutional framework and the high climate and disaster vulnerability of GB, structural and non-structural approaches can be used to manage and minimize disaster risks. The structural approach involves high financial cost and high time completion. These constraints make it an unfeasible option to manage disaster risks.

Under these circumstances, a non-structural approach can be used as an alternative to manage and transfer disaster risks. Flood insurance is a classic example of a non-structural approach. This study also examines the feasibility of the flood insurance market in Skardu. With the help of the Discrete Choice Model (DCM), WTP for flood insurance is determined and details discussion is discussed in below sections.

4.3 Willingness to Pay for Flood Insurance

The Willingness to pay for flood insurance to compensate for home damage is determined by using the Discrete Choice Model (DCM). The methodology of DCM is completed in three steps. First identification of attribute and attribute level, second formulation of choice cards, and in the last step econometric models are applied to get the desired outcome. In this study, three attributes are selected. The two attributes; insurance coverage and premiums consist of three levels of attribute while the third attribute provider consists of two levels. With the help of partial factorial eighteen choice cards are selected. The conditional and multi-nominal logistic models are used to get desired outcomes.

4.4 Analysis of Discrete Choice Model

Primary data is collected from 102 respondents of flood-affected people in the District of Skardu to explore WTP for flood insurance. Before asking questions, it was made sure respondents became familiar with the questions and research objective. The questionnaire was divided into three groups, demographic characteristics, past flood experiences, and WTP for flood insurance of the respondents.

4.4.1 Demographic Analysis of the Respondents

The demographic characteristic of the respondents is explained in Table 6. The age of the respondents was divided into three categories: 55% of respondents fell in the category of 31-45 years of age followed by 33% in the 46-65 age bracket and 12% in the 19-30 years of age. Most of the respondents (45%) had completed 9-12 years of education, 30% of the respondents had completed 13-16 years of education and 16% had 0-5 years of education. In the case of occupation, 34% of the respondents were businessmen, 32% were government employees, 25% belonged to private

organizations and 9% were daily wagers. Most of the respondents were either government employees or businessmen as a result the majority of respondents (50%) had monthly income of PKR 45,001-99,999 that followed by 44% and 6% of 00-45,000 and 100,000 and above respectively. About 63% of the respondents had a nuclear family system while 37% lived in a joint family system. In the questionnaire, total family members and earner family members were also asked. In the case of family members, most of them (64%) belonged to the category of 4-8 members, 28% to 9-14 members, and only 8% fell in the category of 15-18 family members. As most of the respondents lived in the nuclear family system that also reflected in the family earner member number. According to 59% of the respondents they had only one earner in their family while 25% of the respondents responded two family members as earners in their family.

In GB, due to harsh cold weather, people prefer to live in Kacha houses. In this study, 74% of the respondents mentioned they lived in Kacha houses, and only 26% lived in Pakka houses. The type of house was followed by a question about the total areas of the house. Most of the respondents (64%) mentioned 4-6 marla areas of their houses, 25% mentioned 7-9 marla and 11% mentioned 10 and above 10 marla areas of their houses.

Table 6 **Demographic Characteristics of the Respondents**

Variable	Frequency	Percentage
Age		
19-30	12	12%
31-45	56	55%
46-65	34	33%
Years of Education		
0-5	16	16%
6-8	08	08%
9-12	46	45%
13-16	31	30%
17-18	01	01%

Occupation	33	32%
Government Employee	26	25%
Private	34	34%
Businessman	09	09%
Daily Wager		
	45	44%
Monthly Income (PKR)	51	50%
00-45,000	06	06%
45,001-99,999		
100,000 and above		
Family Type		
Nuclear	64	63%
Joint	38	37%
Family Members		
4-8	65	64%
9-14	29	28%
15-18	08	08%
Earner Family Members		
01	60	59%
02	26	25%
03	08	08%
04	08	08%
Type of House		
Kacha	75	74%
Pakka	27	26%
Areas of House (Marla)		
4-6	65	64%
7-9	26	25%
10 and above	11	11%

(Author Estimation)

In past extreme weather events frequency was low, but now frequencies have increased due to climate changes. In this study, all respondents were flood-affectees of the last five years. The Figure 11 shows the experience of the respondents to flood in the last five years All respondents faced a flood at least once a time in the last five years. Most of the respondents had faced one flood event in the last five years while some faced flood events twice and thrice time.

Figure 11 **Flood History of Last Five Years (%)**
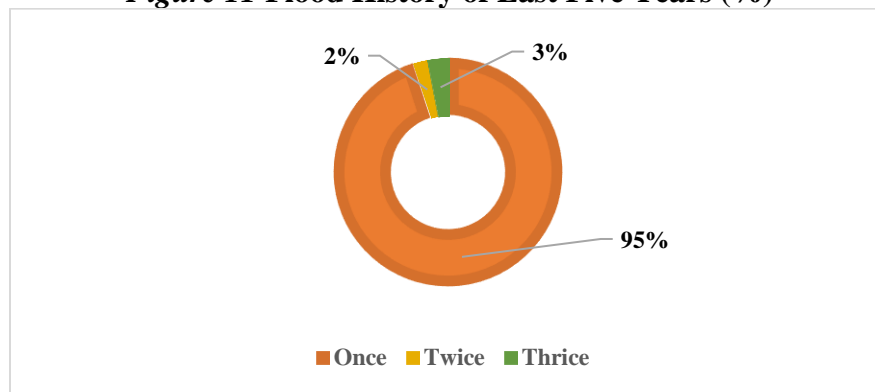
(Author Estimation)

In the last five years, all the respondents had faced a flood at least once a time. During these events, people faced various types of damage such as fruit trees, non-fruit trees, and houses. In this study, respondents mentioned various types of damage they faced during flooding. Figure 12 shows respondents' responses about various types of damage during different flood events. The majority of respondents 44% mentioned non-fruit trees, followed by fruit trees 25%, and 15% to livestock.

*Figure 12***: Major Type of Flood Damages in District Skardu (%)**
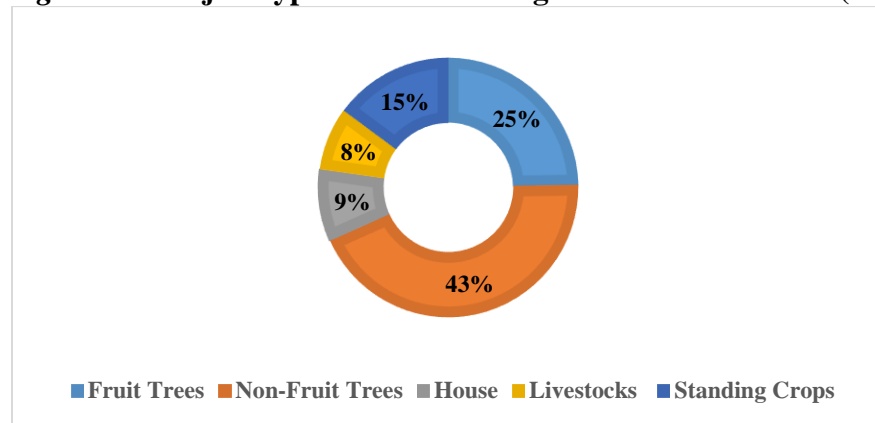
(Author Estimation)

As in Figure 12 people have faced various types of damages due to different flood events in District Skardu. In order to compensate for floods and other disaster damages, the government of GB has allocated specific compensation funds. In 2022 the government of GB revised compensation rates for affectees of natural disasters. However, in this study respondents mentioned that they didn't receive any compensation from the government of GB. Figure 13 shows that 77% of the respondents did not receive government compensation for their damage due to the floods in the last five years.

Figure 13: **Respondents about Receiving Government Compensation (%)**
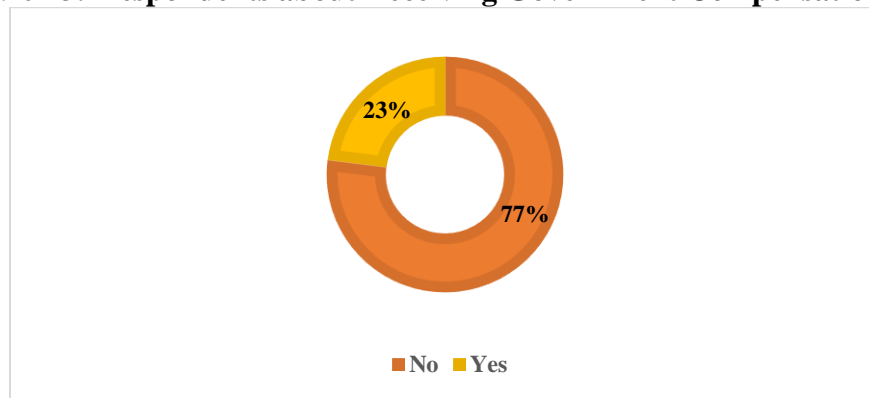
(Author Estimation)

When respondents mentioned various types of flood damage and government compensation mechanisms. Then asked them about their WTP for flood insurance. Flood insurance is a crucial element for flood risk reduction as it provides financial support to the people (Kousky, 2018; Li and Landry, 2018). In Figure 14 it is mentioned that 83% of the respondents were willing to pay for flood insurance while 17% were not willing to pay for flood insurance. The majority of respondents agreed to pay for flood insurance because they have faced various types of flood damages. In addition to this, respondents were not receiving any kind of financial help from the government of GB. In order to compensate for future damages and financial support respondents showed their willingness for flood insurance.

46

17%

83%

■Yes ■No
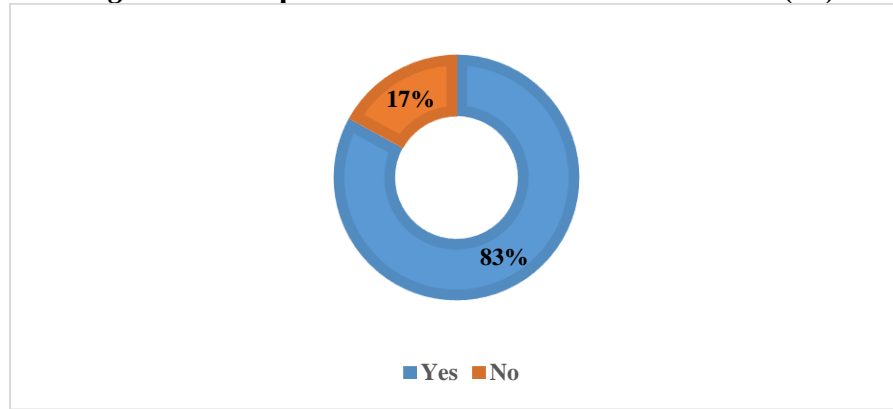
(Author Estimation)

Different socio-economic factors were associated with non-willingness to pay for flood insurance in District Skardu. In this study, respondents mentioned two reasons for not WTP for flood insurance; lack of trust with insurance companies and affordability. About 65% of respondents mentioned affordability as the reason for non-WTP for flood insurance while 35% mentioned lack of trust in insurance companies Figure 15

Figure 15: **Reasons for Non-WTP for Flood Insurance (%)**

35%

65%

■Lack of Trust ■Unafforable
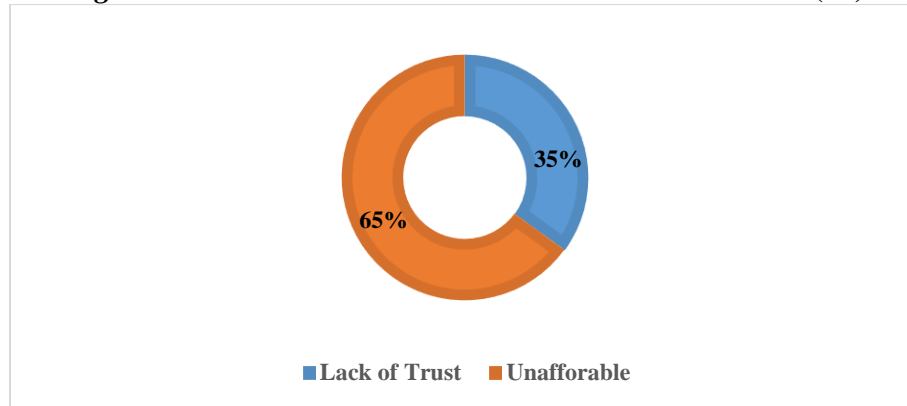
(Author Estimation)

For each choice card, three options were presented. The first two options presented different combinations of attribute levels while the third option was none of them (status quo). The Figure 16 shows the frequency of status quo of the choice cards. When choice cards were presented to the respondents, they selected the status quo option for 13 cards out of 18. The highest frequency of selecting the status quo option was choice card number 3 (23 respondents) followed by choice card number 7 (15 respondents) and choice card number 8 (10 respondents).

Figure 16: Selection of Status Quo Option of the Choice Cards
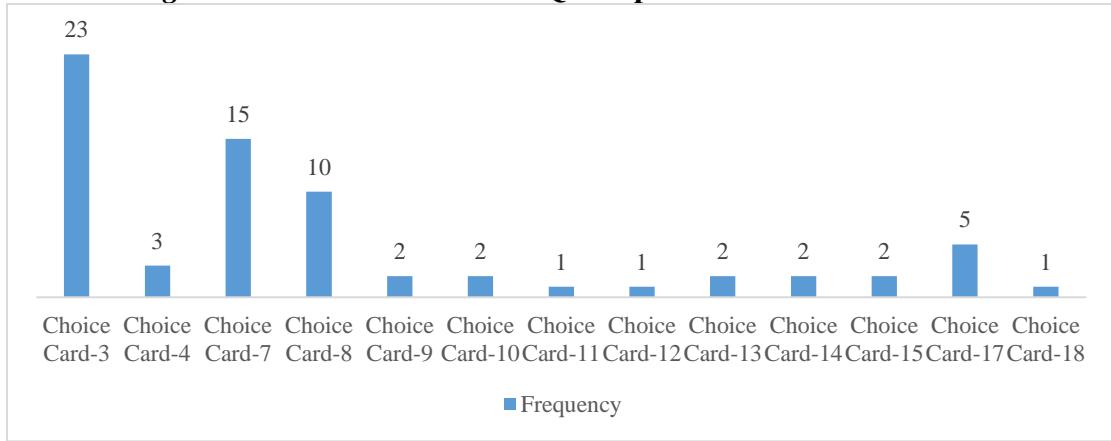
(Author Estimation)

All the respondents mentioned various reasons for the selection status quo of choice cards. Less trust in government and private providers, high premium rates, and low coverage levels were mentioned reasons by respondents. Figure 17 shows the percentage of reasons to select the status quo option by the respondents. For choice cards 3,7,8,9, and 17 less trust in private providers was the main highlighted reason for the chosen status quo option. In the case of choice card-4 less trust in the government provider was the main reason. The high premium rate was mentioned as a reason for non-selection to choice cards 10, 11, 12, and 14 while for choice cards 15 and 18 lower coverage rate was the reason.

Figure 17: Reasons for Selection of Status-Quo Option (%)
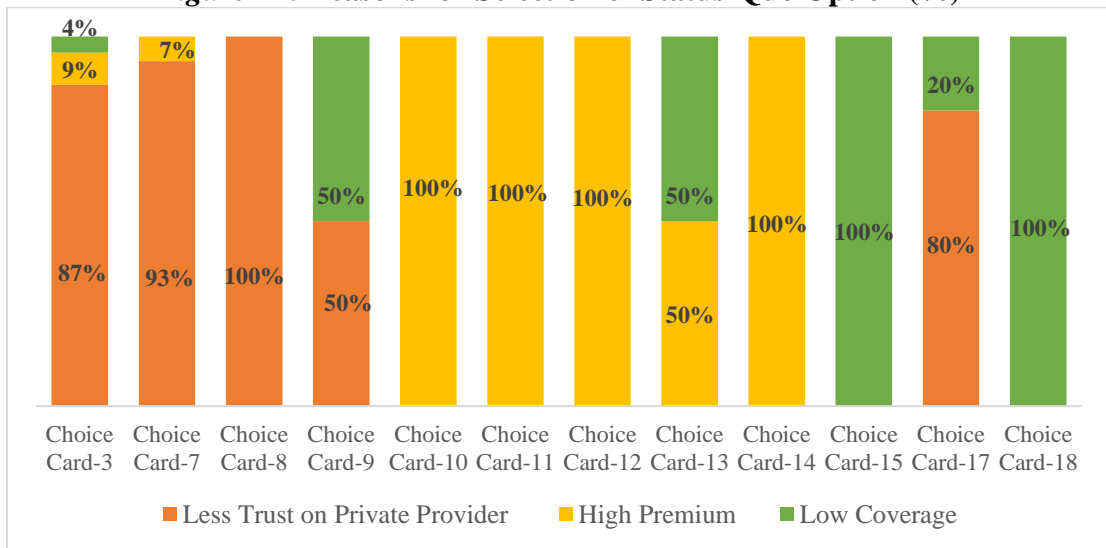
(Author Estimation)

4.4.2 Result of Conditional Logistic Model (CLM)

The conditional logistic model is used to determine the relationship between WTP and the attributes of the product. Table 7 shows the result of the conditional logistic model. The attributes of the hypothetical insurance product are significant at the 99% confidence interval. The positive coefficient of the insurance coverage predicts with an increase in insurance coverage, the WTP for flood insurance also increases.

The negative coefficient of the insurance premium suggests that with the increase in the amount of insurance premium for WTP, flood insurance decreases. People prefer to choose insurance having low premiums and high coverage. This result is coherence with the result of Abbas et al., (2015), Fahad and Jing, (2018), Navrud and Vondolia, (2020)

The provider's negative coefficient states the respondents prefer the government as a flood insurance provider over to the private. In Vietnam and Bangladesh, a similar result was concluded by Reynaud et al., (2018) and Brouwer and Akter, (2010) respectively. In the case of Skardu, it has been observed that in the last few years, some private insurance and savings companies have scammed millions of rupees from the local communities. Now local communities have trust issues with private insurance companies which is also reflected in this study.

Table 7: Result of Conditional Logistic Model

Parameter	Estimate	Standard Error	P-value
Insurance Coverage	0.000006***	0.0000003	0.000
Insurance Premium	-.0003741***	.0000198	0.000
Provider	-1.124676***	.06067	0.000
Number of Attributes	3		
Level of Attributes	Insurance Coverage =3 Insurance Premium=3 Provider =2		
Choice Cards Presented	18		
Number of Obs.	4,590		
LR chi2(3)	1266.66		
Log likelihood	-2237.0377		

(Author Estimation)   (***Significant at 1% , ** 5%, *10%)

4.4.3 Result of Multinomial Logistic Model (MLM)

The multinomial logistic regression model is used to analyze the impacts of socioeconomic factors on the decisions of the respondents. In this study, three variables, level of education, number of earners, and location of the respondents are studied. The referent category of this study was option 3 (status quo).

Table 8 shows the result of multinomial regression. The number of earners in the family is significant at 5%. According to the Brouwer et al., (2014) affordability plays a vital role in purchasing flood insurance. When the number of earners in a family increases their affordability also improves. When affordability improves people try to transfer their disaster risk. With the increase of earner number, the log adds for WTP to flood insurance is increased by 0.225 and 0.255 for options model 1 and model 2 respectively.

The level of education is significant only for choice card 1. When respondents become more educated, the log adds for WTP to flood insurance increased by 0.113. When people become educated, they understand the importance of disaster risk transfer mechanisms. They try to minimize disaster risk and purchase flood insurance. Similarity results were also concluded by Doherty et al. (2021), Finger and Lehmann, (2012) , and Li et al. (2017).

The location and choice of the respondents have a negative relationship. This result is also significant to 5%. In this study, the location was divided from highly flood-prone areas to least least-prone areas. The high flood-prone areas scale as 1 while 4 for the least flood-prone areas. When the location of the respondents is located near to main city they show the least willingness for flood insurance. While respondents live near flood sites such as streams and rivers, they are more willing to pay for flood insurance. When the location of the respondent moves to high flood-prone areas, the log adds for WTP to flood insurance decreased by 0.196 and 0.237 for model 1 and model 2 respectively.

In most parts of GB, people construct multiple storage houses along with small gardens for fruits and vegetables. The lower portion is used for livestock while the upper portion is used for family. People who live in highly flood-prone areas have more

chance of flood. They have also a high chance of monetary damage such as houses, livestock, fruits, and vegetables.

Table 8: **Result of Multinomial Logistic Regression**

Parameters	Function Number	Estimate	Standard Error	P-value
Intercept	1	1.487***	0.341	0.000
	2	1.601***	0.414	0.000
No of Earner	1	0.225**	0.106	0.034
	2	0.255**	0.106	0.016
Education	1	0.113**	0.0565	0.014
	2	0.088	0.0567	0.136
Location	1	-0.196***	0.079	0.005
	2	-0.237***	0.080	0.004

(Author Estimation)   (***Significant at 1% , ** 5%, *10%)

Chapter 5
CONCLUSION AND POLICY RECOMMENDATIONS

This is the last chapter of this study. In the first portion, a brief conclusion of the study is discussed. After the conclusion, some policy recommendations are presented to improve the effectiveness of DDMA in District Skardu in implementing DRR and to introduce flood insurance policies in District Skardu and Gilgit Baltistan.

This study focuses on the second and third priorities of the Sendai Framework for Disaster Risk Reduction in GB. According to the second priority disaster governance should be strengthened at the national and sub-national level. To improve and strengthen disaster governance in GB disaster management authorities have been established at the district level. However, there are many challenges and hindrances to the effective implementation of DRR in GB. This study highlighted the effectiveness and barriers to the DDMA of District Skardu in implementing DRR in District Skardu. To measure the effectiveness of DDMA in District Skardu, key-informant interviews were conducted with different government agencies, academia, and non-governmental organizations. The Government agencies were the District Disaster Management Authority, Skardu Development Authority, Department of Local Government and Rural Development, Recuse1122, Department of Public Health Engineering, Gilgit Baltistan Public Works Department, Directorate of Planning and Development Baltistan Division, and Department of Water Management. For an academic point of view, the interview was conducted with faculty members and researchers from the University of Baltistan. Along with the government agencies, different non-government agencies are also involved in disaster-related activities. On a large scale, disaster-related activities are carried out by two non-government agencies: the Agha Khan Foundation and the United Nations. Agha Khan Rural Support Program was interviewed as a representative of the Agha Khan Foundation and United Nations Development Programs for the United Nations.

With the help of thematic analysis, eight themes emerged for the effectiveness of the DDMA of District Skardu in implementing DRR. The eight themes were, Disaster Risk Identification and Assessment, Disaster Vulnerability Assessment, Disaster Preparedness Planning, Early Warning Systems, Community Engagement and

Participation, Coordination and Collaboration, Response and Recovery, and Resources Allocation.

The lack of proper disaster risk and vulnerability assessment appeared as themes indicating serious concerns for the effective implementation of DRR in Skardu. Currently, it is done based on historical trends. Now it has become difficult to assess disaster risk and vulnerability according to historical trends due to the increase in average temperature and climate change.

The District of Skardu is highly vulnerable to different types of disasters such as flash floods, landslides, soil erosion, and earthquakes. In addition to this, people also live in far-flung and mountainous regions. However, the DDMA District Skardu still hasn't formulated disaster preparedness plans according to geography and the types of disasters that occur in District Skardu. This shows the ineffectiveness of the DDMA District Skardu in implementing DRR measures.

The lack of functional EWS in District Skardu further intensifies the ineffectiveness of DDMA. Besides, a highly vulnerable to climate change and its associated disaster risks currently there is no functional EWS in District Skardu. Financial constraints, local community resistance, and inaccessible geography are the main reasons for non-functional EWS in District Skardu.

Engagement and participation of local communities are prerequisite conditions for effective implementation of DRR. To implement DRR, the DDMA engages with local communities indirectly. They have close coordination with the Nambardar and imams of mosques to engage the local community and information sharing. In this case, the non-government agencies are more active. They have established local community disaster management authorities for proper engagement and participation of the local community in DRR.

The weak coordination and collaboration of DDMA with other line government agencies appear as other themes in this study. When any disaster happens strong coordination and collaboration are essential for the effective implementation of DRR. But in District Skardu during such a situation DDMA has very weak coordination and collaboration mechanisms with its other line government agencies. Delays in

government procedures, traditional modes of information sharing, and red-tapping are the main reasons for weak coordination and collaboration.

Response and Recovery activities are important elements of DRR. The DDMA follows two different mechanisms for response and recovery activities. First, in the case of any infrastructure damage, power disruption, and water channel they coordinate with other line government agencies such as the Department of Public Health Engineering and Gilgit Baltistan Public Works Department for response and recovery activities. While in the case of any casualties, injuries, and house damages the DDMA compensates victims according to the Gilgit Baltistan Disaster Compensation Rate policy. However, due to weak coordination with other government departments, financial constraints, red-tapping, and disputes among local communities, response and recovery activities are not efficient and effective.

The lack of sufficient resources also highlights the ineffectiveness of DDMA in the implementation of DRR. The DDMA does not have enough human resources. The current Assistant Director of DDMA District Skardu is working without any proper office setup along with only two allied staff. In addition, he has the additional responsibility of District Shigar, Furthermore, insufficient financial resources and a limited number of equipment/machinery also show the ineffectiveness of DDMA in implementing DRR. The available equipment/machinery is not according to international standards. In the case of financing, some amounts of funds are allocated in the annual budget of GB in the non-expenditures category while in case of any emergency funds are released according to the GB Finance Act 2023.

The third priority of the Sendai Framework stresses investing in structural and non-structural measures to make communities resilient against disaster. Flood insurance is a non-structural approach to making a community resilient against flood and its associated risks. The determination of Willingness to Pay for flood insurance was the second objective of this study. The WTP for flood insurance is determined by using the Discrete Choice Model. This model is completed in three steps. In the first step appropriate attributes and attribute levels are selected. To select appropriate attributes and attribute levels, expert interviews are conducted with climate experts, local insurance providers, and local communities. The second step is to determine the

number of choice cards. After completion of expert interviews and finalization of attributes and their level eighteen choice cards are developed by using partial factorial. In this study, three attributes are insurance coverage, insurance premiums, and insurance providers. The insurance coverage and insurance premium are further divided into three levels while providers into two levels.

After determining attributes and attributes level, primary data is collected for 102 respondents. All of them are flood victims in the last five years. In this study, the mean age of respondents is 41.61, year of education 11.05, monthly income PKR 56078.43, the family members 8.24, and the area of the house is 6.59 marla. In this study, 83% of the respondents show their willingness to pay for flood insurance to compensate for future damages of the flood. While 17% don't show their willingness to pay for flood insurance. The respondents mentioned unaffordability and lack of truth with insurance companies as the main reasons for their unwillingness to pay. When a respondent showed his WTP for flood insurance, the eighteen choice cards were presented to him. The choice cards consist of three options; the first two options are different combinations of attribute levels while the third was none of them (status quo). Respondents selected third option for the choice cards 3,4,7,8,10,11,12,13,14,15,17 and 18. Among them, choice card-3 has the highest frequency of non-selection for choice card-3 in which 23 respondents selected the third potion, followed by a frequency of 15 to the choice card-7 and a frequency of 10 to the choice card-8. Respondents mentioned four reasons for selecting none of them: less trust in providers, high premiums, and low coverage.

In the Discrete Choice Model, the use of the appropriate econometric model to get desired outcomes is the last step. In this study, the conditional logistic model is applied to determine the effects of attributes of choice cards on the choice of the respondents. The result shows people prefer flood insurance having high coverage and low premiums and the government as the provider. To explore the impact of socioeconomic factors on the decision of the respondents the multinominal regression model is used. In this study earner number in family, education level, and location of the respondents are the socioeconomic variables. The referent category is the third option (status quo).

The number of earners in the family is found significant at 5% for both models. When the number of earners in the family increases, affordability increases which leads to more willingness to pay for flood insurance. The education level is also significant at 5% but only for model one. When education level is enhanced people's knowledge about risk transfer improves as a result, they show a willingness to pay for flood insurance. The location of the respondent is the third variable. The relationship between the decision of the respondent and the location of the respondent is found negative and significant at 5%. In this study, the area is arranged from highly prone to least prone areas. The high prone area is scaled as 1 while 4 was for the least prone area. When the respondents lived near to city side or center village that is less prone to flood, they showed less WTP for flood insurance than high flood-prone areas. The probability of floods and damage as a result of floods is high for high-flood-prone areas as a result they showed more WTP.

5.1 Recommendations

For the effective implementation of DRR district Skardu, the following are some policy recommendations,

5.1.1 Approval of Schemes:

The Multi Hazards Vulnerability and Risk Assessment and the master plan of district Skardu should be approved by the GB government. With the help of these schemes disaster risk and vulnerability assessment can be carried out in to scientific way and DRR can be implemented effectively according to the disaster and geography of the region.

5.1.2 Centralized Coordination Committee:

For better implementation of DRR, there should be a separate coordination committee consisting of different government and non-government agencies such as DDMA, SDA, Works Department, PEH, Forest Department, UNDP, and WWF which should meet monthly or bi-monthly basis. With the help of this mechanism, departmental measures and policies about DRR can be aligned and implemented in a better way.

5.1.3 Community Disaster Management Committee

In some parts of district Skardu, international organizations have established the Community Disaster Management Committee. The DDMA should collaborate with international organizations and establish more Community Disaster Management Committees in all villages of district Skardu. A certain number of volunteers should be selected and trained. On a bi-monthly or quarterly different training sessions should be arranged for their capacity building. Currently, awareness sessions are arranged by both government and non-government agencies. But in such cases, participations change in every session and targeted objectives and goals are not achieved. Such a committee can also use to direct engagement with local communities. With the help of such committees capacity building and engagement with local communities can be improved and also help in the effective implementation of DRR.

5.1.4 Digitization

Delay in governmental procedures and traditional modes of information sharing is another mentioned issue for effective collaboration and coordination between DDMA with other government and non-government agencies. First, the GBDMA needs to restore its official websites so that people can access information easily secondly with the help of digitized information sharing between government and non-government agencies effectively and less time consuming. Digitization of GBDMA and other line government agencies helps in better collaboration and coordination and also implementation of DRR.

5.1.5 Strengthening of DDMA

There are various ways to strengthen the DDMA of district Skardu. For sufficient human resources, the government should advertise specialized posts for DRR and DRM. In DDMA there should be separate wings such as social mobilizers, research and development, disaster trainers, and monitoring and evaluation. These wings should perform their activities with proper coordination with other wings of DDMA and also outside government and non-government agencies. With the strengthening of DDMA can also formulate disaster plan preparedness and implement DRR more effectively in district Skardu.

5.1.6 Financing of Disaster Risk

The current financing mechanism of disaster risk management needs to be reviewed. First, the provision of emergency should be under GBDMA directly instead of the Chief Secretary and District administrator. Secondly, compensation rates for disasters should be reviewed annually. For better utilization of funds, strong accountability such as details of spending should be public and updated on the GBDMA website.

5.1.7 Training and Refresher Courses

The GBDMA should have a separate and trained wing for disaster training and refresher courses for other government line departments and courses and sessions should be arranged on a monthly or quarterly basis.

5.2.8 Flood Insurance Market

In this study, we find that people are willing to pay for flood insurance. The willingness shows demand for the flood insurance market in GB and Skardu, but on the supply side, there is no mark for flood insurance. This study shows demand for flood insurance however affordability has emerged as an issue. Based on this study, the following are some mechanisms to introduce the flood insurance market in GB and Skardu.

5.2.8.1 International Climate Financing

The government should seek international climate change financing organizations for flood insurance in GB. With the help of this mechanism flow of climate change funds becomes possible and also reduces the affordability issue of flood insurance.

5.2.8.2 Re-Direct of Government Compensation Funds

The government of GB has allocated funds to compensate disaster-affected people. The government should reallocate some amount of compensation to flood insurance. In this way, insurance premiums can be reduced, and also the government will be the provider.

5.2.8.3 Public-Private Partnership

Public-private partnerships can also be used for flood insurance in GB. With this mechanism, flood insurance can be introduced government as a provider and private companies can provide financial support to the government.

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Appendices

Appendix 1

Questionaries to evaluate District Disaster Management Authority in implementing DRR

General Information:

Official Designation	
Type of Organization	
Age	
Gender	

Q1) How does your department identify and prioritize different types of risks within GB and district Skardu?

_____
_____
_____

Q2) What methodologies and tools are utilized for risk assessment?

_____
_____
__

Q3) How frequently are risk assessments updated to reflect changing hazard profiles?

_____
_____
_____

Q4) What are the key challenges in risk assessment and assessment in GB and district Skardu?

_____
_____

Q5) How does your department assess the vulnerability of communities, infrastructure, and ecosystems to various hazards?

_____
_____
_____

Q6) What socio-economic factors contribute to vulnerability, and how are they addressed in risk reduction strategies?

_____
_____
_____

Q7) Are there specific measures in place to address vulnerabilities?

_____
_____
_____

Q8) Are there specific measures in place to address vulnerabilities among marginalized or disadvantaged groups?

_____

_____

_____

Q9) What are the key challenges in vulnerability assessment in GB and district Skardu?

_____

_____

_____

Q10) What preparedness plans are in place at various levels (national, regional, local), and how are they developed and updated?

_____

_____

_____

Q11) How does the department ensure that stakeholders have the necessary skills and resources to respond effectively to disasters?

_____

_____

_____

Q12) Can you provide examples of recent training exercises or capacity-building initiatives conducted by the department?

_____

_____

_____

Q13) What are the challenges in preparedness planning and capacity building in GB and district Skardu?

_____

_____

_____

Q14) How are early warning systems established and maintained, and what mechanisms are in place to ensure their effectiveness?

_____

_____

_____

Q15) How does the department ensure that warnings reach all segments of the population, including vulnerable groups?

_____

____

Q16) Can you describe any recent instances where the early warning system successfully alerted communities to an impending disaster?

_____

_____

_____

Q17) What are the key challenges for establishing early warning systems in GB and district Skardu?

_____
_____
_____

Q18) How does the department engage with local communities to raise awareness about disaster risks and promote preparedness?

_____
_____
_____

Q19) Are there mechanisms in place for community members to actively participate in decision-making processes related to risk reduction?

_____
_____
_____

Q20) Can you provide examples of community-led initiatives supported or facilitated by the department?

_____
_____
_____

Q21) What are the key challenges for community engagement and participation in DRR initiatives?

_____
_____
_____

Q22) How does the department coordinate with other government agencies, NGOs, and international partners involved in disaster risk reduction?

_____
_____
_____

Q23) Are there formal mechanisms for collaboration and information sharing among stakeholders?

_____
_____
_____

Q24) What are the key challenges for proper coordination and collaboration between government agencies and NGOs with your department?

_____
_____
_____

Q25) How does the department coordinate and manage response efforts during disasters?

_____
_____
_____

Q26)What measures are in place to ensure the timely delivery of assistance to affected communities?

_____
_____
_____

Q27) Can you provide examples of post-disaster recovery and reconstruction projects undertaken by the department?

_____
_____
_____

Q28) What are the challenges faced by your department in the response and recovery phase of disaster?

_____
_____
_____

Q29) How are resources allocated to support disaster risk reduction activities, and what criteria are used to prioritize funding?

_____
_____
_____

Q30) How does the department ensure that resources are utilized efficiently and effectively?

_____
_____
_____

Q31) Can you provide a breakdown of the department's budget allocation for disaster risk reduction?

_____
_____
_____

Q32) What are the key challenges faced by your department during resource allocation and utilization of DRR?

_____
_____
_____

Appendix 2

Questionnaire for exploring WTP for Flood Insurance

I, Wajhullah Fahim, am doing my MPhil thesis on "Evaluation of Disaster Risk in GB- A Case Study of Skardu District". Your input will be highly appreciated. Your information and data will be highly confidential and only use for research purposes.

Name		
Gender	Male	Female
Age		
What is your occupation?		
Year of Education		
What is monthly income of your family? (PKR)		
Family Type	Nuclear	Joint
Total number of family members		
Number of working (earner) family members		
Do you have your own house?	Yes	No
Type of house	Pakka	Kacha
Area of house (Marla)		
Location of house		

Do you have experience with past floods in the last five years?		
Year	Yes	No
2019		
2020		
2021		
2022		
2023		

What was the type of effect (damage)?					
Year	House	Livestock	Standing crop	Fruits trees	Non-fruit tress
2019					
2020					
2021					
2022					
2023					

In your opinion: What was the monetary value of the damage?					
Year	House	Livestock	Standing crop	Fruits trees	Non-fruit tress
2019					

2020					
2021					
2022					
2023					

Are you aware about government compensation for flood damages?	
Yes	No

Did you receive compensation for your damage?	
Yes	No

Kindly mention, Amount of Compensation and Provider

Yr	House		Livestock		Standing crop		Fruit trees		Non-fruit tress	
	A	P	A	P	A	P	A	P	A	P
2019										
2020										
2021										
2022										
2023										

*Yr= Year, A=Amount, P=Provider

*In the case of rented house, what is the mechanism of compensation of home damage?

Are you satisfied with the compensation received in previous year

Year	Yes	No	Somewhat	Other comment
2019				
2020				
2021				
2022				
2023				

Are you satisfied with the procedure of government compensation?

Year	Yes	No	Somewhat	Other comment
2019				
2020				
2021				
2022				
2023				

How the current government compensation procedure can be improved?

How much financial compensation should be raised by the government?

Beside, government compensation how do you deal with previous flood damages? Kindly mention amount

Year	LF		BL		LNGO		IO		PS	
	Yes/No	PKR	Yes/No	PKR	Yes/No	PKR	Yes/No	PKR	Yes/No	PKR
2019										
2020										
2021										
2022										
2023										

* LF= Loan from friends, BL= Bank loans, LNGO= Compensation from local NGO, IO= Compensation from international organization, PS= Spending of past saving

Are you willing to pay flood insurance to compensate future damages?

Yes	No

Appendix 3

Choice Cards Used in the Study

Choice Card 1

Attributes	A	B	C
Insurance Cover	600,000	600,000	No
Premium	10,000	7000	
Provider	Private	Government	

Choice Card 2

Attributes	A	B	C
Insurance Cover	600,000	400,000	No
Premium	10,000	4000	
Provider	Government	Private	

Choice Card 3

Attributes	A	B	C
Insurance Cover	600,000	600,000	No
Premium	7,000	10,000	
Provider	Private	Private	

Choice Card 4

Attributes	A	B	C
Insurance Cover	600,000	400,000	No
Premium	7,000	4000	
Provider	Government	Government	

Choice Card 5

Attributes	A	B	C
Insurance Cover	600,000	400,000	No
Premium	4,000	7000	
Provider	Private	Government	

Choice Card 6

Attributes	A	B	C
Insurance Cover	600,000	400,000	No
Premium	4,000	10,000	
Provider	Government	Private	

Choice Card 7

Attributes	A	B	C
Insurance Cover	600,000	400,000	No
Premium	10,000	10,000	
Provider	Private	Private	

Choice Card 8

Attributes	A	B	C
Insurance Cover	400,000	400,000	No
Premium	7000	4,000	
Provider	Private	Private	

Choice Card 9

Attributes	A	B	C
Insurance Cover	400,000	200,000	No
Premium	7000	7000	
Provider	Government	Private	

Choice Card 10

Attributes	A	B	C
Insurance Cover	400,000	400,000	No
Premium	4000	10,000	
Provider	Private	Government	

Choice Card 11

Attributes	A	B	C
Insurance Cover	400,000	200,000	No
Premium	4000	10,000	
Provider	Government	Government	

Choice Card 12

Attributes	A	B	C
Insurance Cover	200,000	200,000	No
Premium	10,000	4,000	
Provider	Private	Government	

Choice Card 13

Attributes	A	B	C
Insurance Cover	200,000	600,000	No
Premium	10,000	10,000	
Provider	Government	Government	

Choice Card 14

Attributes	A	B	C
Insurance Cover	200,000	400,000	No
Premium	10,000	7,000	
Provider	Government	Private	

Choice Card 15

Attributes	A	B	C
Insurance Cover	200,000	200,000	No

Premium	7,000	7,000	
Provider	Private	Government	

Choice Card 16

Attributes	A	B	C
Insurance Cover	200,000	400,000	No
Premium	7,000	10,000	
Provider	Government	Government	

Choice Card 17

Attributes	A	B	C
Insurance Cover	200,000	600,000	No
Premium	4,000	4,000	
Provider	Private	Private	

Choice Card 18

Attributes	A	B	C
Insurance Cover	200,000	200,000	No
Premium	4,000	7,000	
Provider	Government	Private	

Appendix 4

Sampling	UDCs	Data Collection	Data Collection Tools
Purposive sampling	Government Organization	Qualitative Data	Key informant interview
Purposive sampling	Non-Government organization	Qualitative Data	Key informant interview
Purposive sampling	Academia	Qualitative Data	Key informant interview
Convenience sampling	Flood-affected Communities	Quantitative Data	Survey Questionnaire