UNDERSTANDING FLOOD RISK PERCEPTION, COMMUNICATION AND MANAGEMENT: A CASE STUDY OF RURAL COMMUNITY OF D. G. KHAN, PAKISTAN

A thesis submitted in partial fulfillment of the

requirements for the degree of

Master of Science

in

Urban and Regional Planning

by

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May, 2022

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Thesis titled

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has been accepted towards the partial fulfillment

of the requirements for the degree of

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DEDICATION

This work is dedicated to my Beloved Parents who supported and encouraged me throughout my research.

I also dedicate this work to My Thesis Supervisor, Dr. Irfan Ahmad Rana without whom it was impossible to achieve this milestone.

And finally, I dedicate this work to the almighty Allah, who gave me healthy life to meet and complete such targets in my life

ACKNOWLEDGMENTS

Firstly, I am thankful to ALLAH ALMIGHTY, who gave me the strength to complete my research work and this degree. Secondly, I would like to express my gratitude to my respected supervisor, Dr. Irfan Ahmad Rana, for his all-time guidance and suggestions. I would like to express my deep appreciation to Dr. Abdul Waheed and Dr. Fawad Ahmed Najam for their valuable suggestions and help during this research. I am dedicating this work to my family and friends who supported and encouraged me throughout my research.

***(*Asher Ali Khan)**

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Abstract

Climate change-induced extreme events have been increased throughout the globe. The developing countries experience more challenges to deal with floods. There is an immense need for attention in rural areas of such countries to avoid severe losses. Risk communication has been considered an effective mechanism in literature worldwide that affects risk perception and, therefore, can significantly reduce flood risk and improve disaster risk reduction. This study aims to quantify risk perception, risk communication, their determinants and challenges faced by concerned government institutions in flood-prone rural areas of District Dera Ghazi Khan, Pakistan. The rural communities were divided into two zones based on the distance from rivers. 420 samples were collected using a household survey. Chi-square and t-tests were used to identify differences between the two zones and linear regressions analysis for identifying the determinants of risk perception and risk communication. Results showed that the people living away from the river had higher risk perception and received better risk communication than their peers. The main reason was attributed to their past flood experiences. The study also found a strong correlation between flood risk perception and risk communication. Similarly, past flood experience, household size, monthly income, and qualification of the respondents are common drivers of risk perception and risk communication. This study provides an insight into the need for risk communication for improving the effectiveness of flood risk reduction.

KEYWORDS: climate change, Flood risk management, Indus River, risk perception. risk communication

CHAPTER 1

Introduction

1.1 Problem statement

Our planet earth is warming day by day; the sea level is rising glaciers are shrinking. Evidence suggests that humans play a crucial role in changing the earth's climate (IPCC, 2021). Not only the frequency and intensity of hydro-meteorological occurrences have been increased due to climate change, but also the unpredictability of rainfalls has been enhanced (Rahman, 2015). Of all the hydro-meteorological events, floods have been known as one of the most chronic and exorbitant natural disasters (NIDM India, 2013). Hydro meteorological phenomena around the globe are increasing with every passing day (Kellens, Terpstra, & De Maeyer, 2013; Khan, 2011; Krausmann & Mushtaq, 2008; Qasim, Khan, Shrestha, & Qasim, 2015). For many mortal communities, flooding has been a consequential and intensifying challenge. In the previous century, out of all the natural hazards in the world, one-third of them were floods, and out of all the people have been affected by natural disasters, half of them were affected by floods (Adikari & Yoshitani, 2009; Birkholz, Muro, Jeffrey, & Smith, 2014). The recurrence of the floods appears to be increasing and their destruction (Adikari & Yoshitani, 2009; Birkholz et al., 2014; Schanze, 2006).

Pakistan is also no stranger to these occurrences (Ahmad, Kazmi, & Pervez, 2011; Khan, 2013; Qasim et al., 2015). Keeping in mind the present and future climate change scenarios. Due to the growing variability of precipitation and increased melting rate of glaciers the whole world seems to experience more flooding

events. In a country with the same topology as Pakistan, the water from melting glaciers and the runoff waters from the precipitation results in more quantity of water flowing in the rivers. which cause a flooding event (Paul & Routray, 2010).

Literature indicates that with the present climate change situation, the frequencies of floods have increased worldwide, and it is impossible to avoid floods or avoid their damages. Still, with proper flood disaster risk reduction practices, many fatal consequences can be reduced. The literature has observed that the flood preparedness and mitigation measure are dependent on the risk perception of the people (Kellens et al., 2013), and how well they perceived the risk is dependent on how well the risk is communicated to them (Charrière, Junier, Mostert, & Bogaard, 2012). People with better risk perceptions have been seen to take proper measures to steer clear of the risk, which shows that the risk perception and the disaster preparedness are connected (Lepesteur, Wegner, Moore, & McComb, 2008). People are likely to adjust properly to floods if they are made aware of the flood risk (Qasim et al., 2015). How are people made aware of the risks? That is where risk communication comes into practice. How well the risk was communicated to the people determines the effectiveness of risk communication.

1.2 Rationale

The flood risk perception is affected by diverse socioeconomic and demographic components (Bradford et al., 2012; Philip Bubeck, Botzen, & Aerts, 2012; Qasim et al., 2015). Farmers and the general public use a diverse range of strategies to deal with floods. (Qasim et al., 2015) these strategies include both structural and nonstructural measures (Mustafa, 1998; Yevjevich, 1994), changing

cropping pattern (Del Ninno, Dorosh, Smith, & Roy, 2001; Paul & Routray, 2010), involving the people in flood protection programs (Thieken, Kreibich, Müller, & Merz, 2007) and increasing the capacity of the people with proper training and providing necessary resources (Few, 2003)

Gilbert White wrote about human adjustment to floods, which helped start the studies of risk perception in the United States in the 1940s. The invention of nuclear technologies gave rise to the study of people's risk perception in the 1960s. After that, the risk perception studies kept on gaining interest in flood risk management (Kellens et al., 2013).

The United Nations International Strategy for Disaster Reduction (UNISDR) defines risk as to the probability of any loss of life, injury, destruction, and damage from a hazard in an observed timeframe, a hazard is most likely to cause damages, the prevention of these damages is inevitable, but with proper preparedness and attitude management, these damages can be reduced significantly. To achieve such a thing, one must improve the risk perception of the community's people, which is hazard susceptible. The risk perception varies from person to person because everyone is different and has their own set of thought and thinking processes. It has been seen in literature that everyone’s perception of risk/threat is different from each other, i.e., swimming can be perceived as risky among some individuals, and it is perceived not risky for other people. So, people actually perceive something risky or not risky relates to the way they think, feel, and behave. There are many different drivers of these three parameters, a person’s education, culture, religion, age, gender, past experiences, income, demographic characteristics, society, surroundings, and wealth. Similarly, the risk perceptions of experts and the general public are very

different from each other(Dwyer, Zoppou, Nielsen, Day, & Roberts, 2004). Risk perception improves the response and the flood preparedness of the people. People from different backgrounds and disciplines have different views about risk (Sjöberg, Moen, & Rundmo, 2004).

1.3 Scope of Study

In a developing country like Pakistan, where the weather (monsoon) and topology favor the flooding events and with a high poverty index, people tend to move to flood-prone areas where the price of land is relatively cheap. It is impossible to stop the flooding events, but the effects of the floods can be reduced with proper flood disaster risk reduction strategies.

So, in this study, the risk perception of the people living near the riverbank has been assessed and compared with the people residing in relatively farther areas from the riverbank. Also, the determinants for better risk perception have been assessed. Apart from flood risk perception, flood risk communication is also a very important factor of flood disaster risk reduction. It determines how well the flood risk was conveyed to the people living in flood susceptible areas. In this study, the effectiveness of the flood risk communication is analyzed before, during, and after the flood phases to check the effectiveness of the risk communication regarding the disaster risk management cycle.

1.4 Research Questions

This research will mainly focus on answering the following questions.

- What is the risk communication level in the study area and its determinants?

- What is the risk perception of people residing in the study area and its determinants?
- What challenges do the institutions face for effective disaster risk reduction?
- What measures can be taken to improve the disaster risk reduction practices?

1.5 Research Objectives

The precise objectives of this research study are as follows.

- To analyze risk communication and its determinants in the study area.
- To analyze risk perception and its determinants in the study area.
- To assess institutional challenges and issues in effective disaster risk reduction practices.
- To propose coping measures for effective disaster risk reduction.

1.6 Conceptual Framework

Due to climate change, the occurrence of hydro-meteorological disasters is rising. A flood disaster is one of them. Flood risk management deals with various affairs and duties, from predicting floods and their societal consequences to measuring and instruments for risk reduction (Schanze, 2006). A conceptual framework for effective flood risk reduction and climate change adaptation is shown in the figure below.

Flood risk management is a composite cyclic process of risk analysis, assessment, and reduction. Risk analysis gives details of the previous, current, and future flood risks; Risk assessment involves the perception of risks and their evaluation; Risk reduction deals with the interventions to decrease the risks. To

achieve the objective of each task, some components are required here. We will only discuss the risk assessment part. We must improve the public's risk perception for better risk assessment, which can be done efficiently by effective risk communication, as shown in the figure below.

According to the literature, risk perception and risk communication depend on each other to improve the other. We can have better disaster risk reduction and climate change adaptation with all these practices.

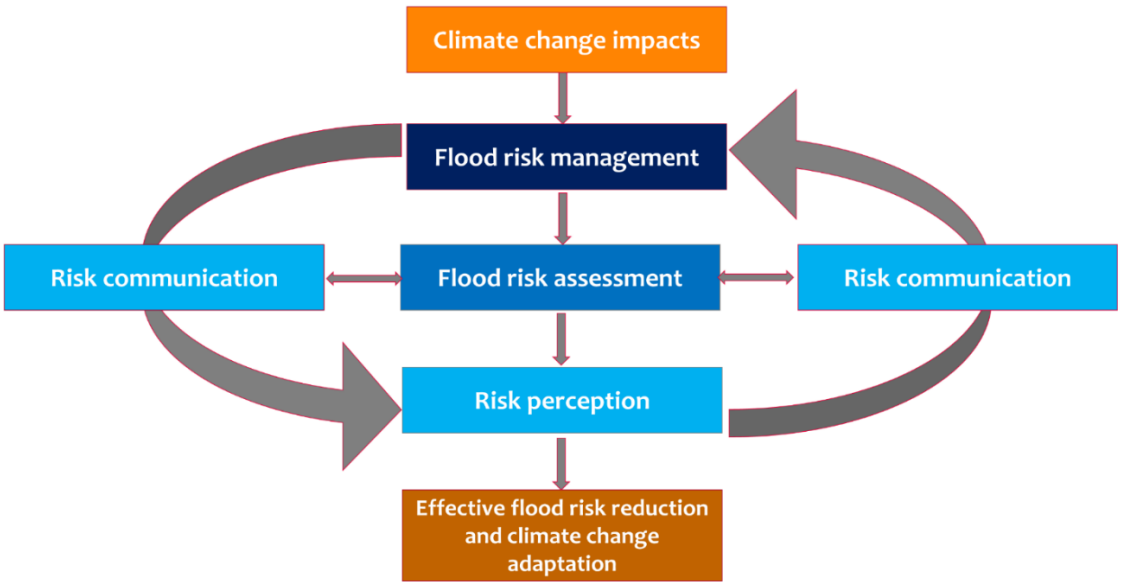

Figure 1 Conceptual framework for risk perception and communication

1.7 Limitations of Study

One limitation of this study is that it measures the effectiveness of risk communication at the response phase of the flood disaster life cycle. As the flood disaster life cycle has four stages: preparedness, response, recovery, and mitigation. But in the field during the data collection, it was very hard for the respondents to understand these four stages and give their responses as most of them are illiterate.

Due to these complications, we could not get the desired data on all four stages of the disaster life cycle. So, people's responses for the effectiveness of risk communication only on the response phase of the flood disaster life cycle are taken in this study. Another limitation is due to the ongoing Covid pandemic, we cannot extend our study to more flood-prone rural areas of the Dera Ghazi Khan Division, which could have painted a more detailed picture, but only one rural area is selected and studied. Still, this study can be replicated in other rural areas of Pakistan.

CHAPTER 2

Literature Review

2.1 Flood Disaster Risk Reduction

According to UNDRR, a disaster is any harmful event that exceeds the capabilities of the affected communities to cope with it and causes widespread losses and disruption in the functioning of the society. Disasters are caused because of the condition of vulnerability, exposure to hazards, and insufficient coping capacity. The adverse impacts of disaster include life losses, injuries, mental distresses, disruption of services, property damages, and economic and environmental degradation (UNDRR, 2017). The Intergovernmental Panel on Climate Change (IPCC) describes disaster as a disruption in the smooth operation of a community due to a hazard intermingling with vulnerable social conditions, resulting in extensive damages that may need external assistance for recovery. DRR is a policy objective and a strategic measure used for foreseeing future disaster risk; reducing exposure, hazard, or vulnerability; and enhancing disaster resilience (Lavell et al., 2012). The concept of DRR means diminishing disaster risks through decreased hazard exposure, reduced vulnerability, effective land, and environmental management, and enhanced disaster preparedness. DRR is a local, regional, and global phenomenon.

After the Hyogo Framework came into being in 2005, the focus started shifting to building disaster-resilient nations. There has been progressive awareness of disaster risk reduction almost everywhere globally, but more focus was on the developing countries. This framework admits that the vulnerability to natural

hazards, in our case floods, has been increasing due to various factors like urbanization, demographic changes and differences, global warming, climate change, and environmental degradation. The Hyogo framework was replaced by the Sendai Framework in 2015. Sendai Framework has been adopted till 2030 for disaster risk reduction worldwide. The preferences of the Sendai Framework include (1) understanding the disaster risks, (2) improving disaster risk governance, (3) building disaster resilience and investing in disaster risk reduction (4) improving the disaster risk reduction practices on all phases of the disaster life cycle.

The most common phenomenon worldwide that poses a threat to human life and infrastructure is disasters, whether natural or manmade. In developing countries, their effects are more severe than the developed countries. It has been observed that the complexities, severities, recurrence, and economic impacts of these disasters have only been increasing. Out of all the disasters, floods are the most frequent and devastating. Floods alone contribute to one-third of all the natural hazards, and of all the people who were ever affected by natural disasters, half of them were affected by floods. In the subcontinent, flooding is one of the biggest challenges. The monsoon season in the summers and the increased melting rate of glaciers results in higher flowrate of water in the rivers, which causes different types of floods throughout the country. The country's mountainous areas are affected by flash floods, cloud burst, glacial floods, riverine floods, etc. The plain areas experience urban and riverine floods.

History shows that rivers, canals, and big water bodies have played an important role in the growth of civilization. The presence of fertile alluvial soil

inspired agriculture, and people tended to move near the flood plains and form their settlements (Khan, 2003).

According to United Nations International Strategy for Disaster Reduction (UNISDR), disaster risk reduction is defined as the concept and practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including through reduced exposure to 11 hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events.

Disaster risk reduction is an incalculable conception, and it has been proved very hard to define or explain in detail. It is a foundational section of sustainable development. It involves all divisions of Government, all the segments of society, and all portions of the professional or private sector. Disaster risk management is an applied form of DRR initiatives. In DRR, all the fields like preparing efficiently for the disasters, the effective response at the time of the disaster, recovering from the disaster's effects, and mitigation measures taken to reduce the adverse effects of disasters are included.

Disaster risk reduction came into existence over the years from disaster management. The paradigm kept on changing from 1940 till now. From the 1940s to the 1970s, the approach was responding to disaster events, emphasizing response and relief. From 1971 to 1999, the approach shifted from responsive to cognitive and prevention, and pre-disaster preparedness measures were recognized. From 2000 to 2014, the approach became reactive, and emphasis was when a disaster risk is identified, it can and should be reduced. From 2015 anticipatory approach started, which tells that disaster risk can and should be prevented and managed. The risk was

considered as an external factor in the development, but now it is seen as an inherent factor in the development. The focus was to prevent the hazards and manage people's exposure, but now it is on reducing vulnerability and the risk. Before, single agencies worked individually, but now partnerships have been formed to work together for the shared goal.

The paradigm has shifted from science-driven to multi-disciplinary earlier. The plans were made by the experts for the communities now. It has shifted to the plans being made with the participation of communities. Similarly, the earlier practice was to communicate any information or risks for the communities, but now the paradigm has shifted to communicating the information or any risk with the participation of communities so the message can reach every segment of the communities.

2.2 Disaster Risk Reduction Cycle

The Tiros-1 satellite started the practice of meteorological forecasts in the 1960s. This development helped in observing the earth from the sky. It became easy to monitor weather patterns and forecast any coming hazard. It was realized that now disaster risk management could be more effective. This breakthrough helped in better monitoring, understanding, and predicting meteorological hazards (Le Cozannet et al., 2020; Manna, 1985). This space-based monitoring system helps the meteorologists in their computations, so they started wondering how much they could use this satellite to monitor other hazards like coastal, hydro-meteorological, and geo-hazards. Many hazards like soil erosion, coastal erosion, ground water on the coastal areas, floods, tsunamis, landslides, the sinking of the soil, volcanic eruptions, earthquakes, and wildfires have been addressed by various initiatives (Le

Cozannet et al., 2020). These initiatives contain the Integrated Global Observing Strategy (IGOS) 1998, The Group of Earth Observations (GEO) 2003, The European Program Global Monitoring for Environment and Security (GMES), it is now known as Copernicus.

The collectives goal of these programs was to form a network of satellites for better observing the indicators of risks and conveys them to the governing bodies of the areas at risk with the help of data being uploaded on any global server and finally helping the vulnerable communities from disasters (Le Cozannet et al., 2020). Keeping the present Disaster Risk Reduction situation worldwide and, on the other hand, looking at the existence of these programs for such long times show making this vision real is not an easy task (Denis et al., 2016). Disaster Risk Reduction is very composite and complex because of many types of disasters and because it crosses different types of policies (Romieu, Welle, Schneiderbauer, Pelling, & Vinchon, 2010). According to UNISDR, disaster risk reduction can be explained as the arrangement, designing, and practical implementation of all the activities to effectively prepare, respond, and recover from disasters.

IPCC uses kind of the same definition, which explains disaster risk management as a process "for designing, implementing and evaluating strategies, policies, and measures to improve the understanding of disaster risk, foster disaster risk reduction, and transfer, and promote continuous improvement in disaster preparedness, response and recovery practices." The second definition stresses the governance and institutional dimension of disaster risk management. In both cases, disaster risk management mentions all actions and decisions that minimize losses

from disasters. The earth observations rely on satellites-based remote sensing and in situ and aerial monitoring instruments (Balsamo et al., 2018).

The Sendai Framework (2015-2030) has the priorities of Understanding disaster risk, strengthening disaster risk governance for managing disaster risk, investing in disaster risk reduction for resilience, enhancing disaster preparedness for effective response, and building back better in recovery rehabilitation and reconstruction. All these priorities can be better carried out by better earth observation. The people who are observing the earth through satellites are not in charge. They just convey the data to the respective users, who will take the data and can manage the disaster risk. The disaster risk management cycle consists of a broad spectrum of actions to reduce the effects of disasters. The actions are categorized with each step of the disaster management cycle whose primary goal is to achieve the targets of the Sendai framework of disaster risk reduction. The priorities of Sandai Framework include (1) reducing number of deaths due to disasters (2) reducing the number of affected people from disasters (3) reducing economic losses due to disasters (4) reducing the damages caused by disasters to infrastructure (5) increasing the number of countries having proper disaster risk reduction strategies (6) enhancing international cooperation and providing access to early warning systems. This can be achieved by preparing the most vulnerable countries and communities, typically the underdeveloped and the developing countries, and building resilience for better disaster risk reduction.

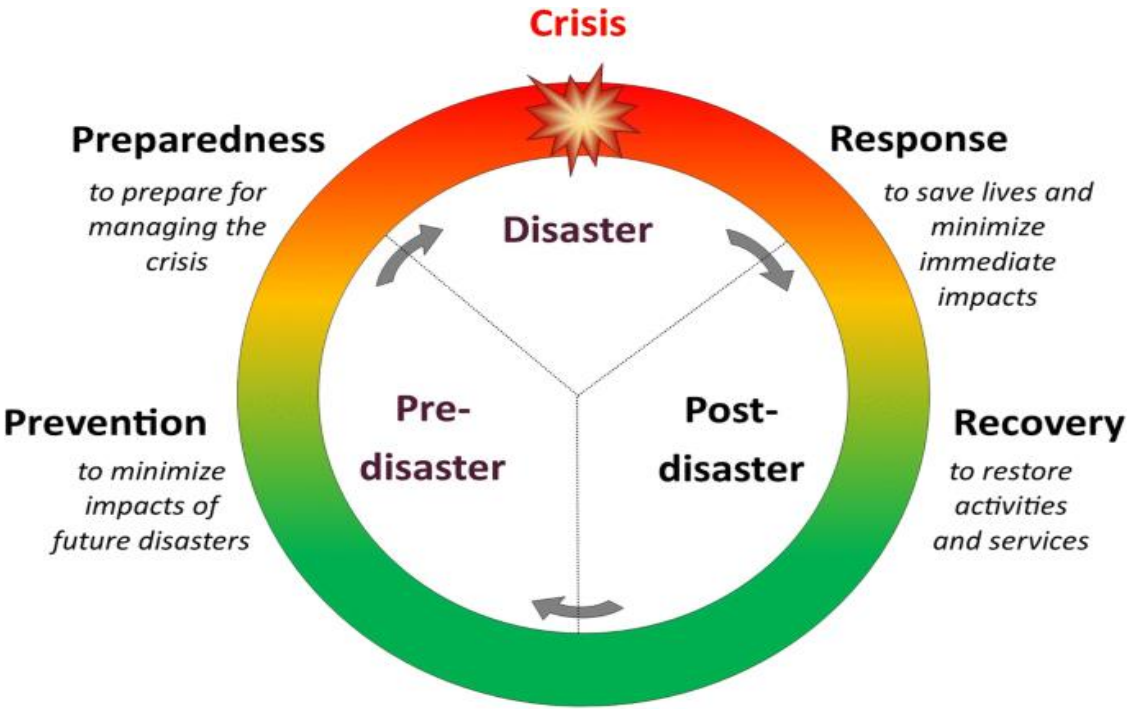

Figure 2 Disaster management cycle

As shown in the figure, prevention includes, preparedness includes the actions aiming to prepare the communities for the flood disaster and manage the floods efficiently, leading to reduced future losses. Response, as shown in the figure, includes all the actions taken at the time of floods to save precious lives and reduce the immediate impacts of the floods. Recovery includes all the actions to rebuild services and infrastructure to continue human activities. It can also be seen that quite simply, there are three phases of the disaster management cycle pre-disaster, during a disaster, and post-disaster. We have accessed the effectiveness of the risk communication on all these three phases of the disaster management cycle.

2.3 Flood Risk Perception and Flood Risk Communication

Throughout the disaster management cycle, flood risk communication plays a very important role in reducing the damages caused by floods and saving precious

human lives. A question can come to mind what exactly does risk communication do? It not only upraises the awareness of the people but also substitutes the behaviors of every stakeholder involved. How will people perceive a flood risk is dependent on how the risk is communicated? It is very easy to say that risk communication must be effective. But it is very hard to deliver that because of all the little details and complexities present in the communities. Studies are being carried out worldwide to improve the risk communication strategies to make people take disaster risk seriously and prepare for them by taking all necessary mitigation measures to save themselves from the adverse effects. But still, there is a need for improvement. Unlike other disasters, floods have a relatively slow onset in most cases and are predictable, so they give some warning time before hitting communities. Floods cannot be stopped, and the damages caused by floods cannot be avoided. Evidence suggests that with proper disaster risk reduction strategies, the effects can be minimized, like in most developed countries.

2.3.1 Flood risk Perception case studies

(P Bubeck, Botzen, Suu, & Aerts, 2012) This study has been carried out in the coastal province of Thien Hue, located in central Vietnam. This study area gets affected by typhoons, floods, and drought frequently, which causes damages to precious human life, infrastructure, and the economy of the region. This study examines the assumptions that have gained attention in Europe and the developing countries in the recent decades of implementing nonstructural measures on the household level and structural measures for better flood risk reduction. A questionnaire survey was developed, and the data was collected from 300 households in central Vietnam. The results showed important implications on risk

communication policy and the simulation of private precautionary behavior. This study suggests that flood risk awareness is not a promising approach to improving flooding protection, but flood coping appraisals provide more fruitful results in precautionary behaviors. The flood coping appraisals consists of person's perception of the effectiveness of flood mitigation measures, their perceived ability to implement these measures, and the perceived cost of the mitigation measure in terms of money, time, and emotions. Therefore, future flood risk communication should provide the cost-effectiveness of the mitigation measures along with the guidance of how to implement them rather than just keeping risk perception in mind.

(Armas, Ionescu, & Posner, 2015) Risk can be seen as both quantifiable and subjective objectives, constructed at an individual level. This paper focuses on the latter and aims to explore flood perceptions in relation to socio-demographic variables and various economic measures. The data were drawn from four villages on the banks of the Danube using quantitative questionnaires, the villages data sheet, and in-depth semi-structured interviews. This mixed-method approach allowed for ecologically sound findings. Inequality of income and capital are linked with variations of some risk perception dimensions such as disaster temporal proximity, perceived resilience, and a reluctance to think about the future and the dangers it might pose. Past floods are associated with most dimensions tested, including income, inequality, and whether the next flood appears to be imminent. Lower-income households expect some form of assistance not from the community, the church, or local authorities but the government. This highlights the erosion of social values, or inter-household monetization, as the other major issue, alongside

inequality, faced by rural populations living on the banks of one of Europe's greatest rivers.

(Ullah, Shivakoti, & Ali, 2015) Farmers' risk attitudes and perceptions are crucial factors affecting their farm production, investment, and management decisions. Risk-averse farmers are less willing to take on activities and investments with higher expected outcomes but carry risks of failure. This research attempts to quantify farmers' perceptions of catastrophic risks their risk attitude and assess the effect of farm and farm household characteristics, farmers' access to information, and credit sources on their risk perceptions and risk attitude. Equally, the Likely Certainty Equivalent approach is used to elicit farmers' attitudes towards risk. The risk matrix is used to rank farmers' perception of four calamitous risk sources: floods, heavy rains, pests, diseases, and droughts. The results revealed that the majority of the farmers are risk-averse in nature and consider floods, heavy rains, and pests and diseases to be potential threats to their farm's enterprise. Age and education of the household head, off-farm monthly income, land ownership status, and farmer's access to informal credit sources significantly affect farmers' attitude towards risk. The effects of socio-economic and demographic factors on farmers' risk perceptions are insignificant, while access to formal information and informal credit sources adds to the risk perceptions of farmers. The study provides useful insights for farmers, agricultural policy makers, extension services, researchers, and the agricultural insurance sector. Understanding farmers' risk attitude and risk perceptions have implications for policy makers and research institutions in providing farmers with accurate information, formulating sophisticated risk management tools, and providing agricultural credit and extension services.

(Chiang, 2018) in this study, the community risk perception of the people living in the flood-prone lower reaches of the Taliaokeng river in new Taipei city has been assessed. Taiwan is one of the most disaster-prone countries in the world, with 73% of its land and population exposed to flooding, typhoons, and heavy rains. It became a routine that after every rainfall, there will be flooding in some areas of the city. the regional phenomenon of increased rainfall due to the present global climate change scenario is very likely to cause flash floods in Taipei city due to the low-lying lands and overdeveloped urban areas which pose a threat to the lives and safety of the residents. This study has provided insights on the risk perception of the residents of the flood-prone area that can help in the risk communication for taking better actions in responding to climate change. It is stressed that the community risk perception is a factor in increasing local awareness of the climate risk. This study uses the driver-pressure-state-impact-response cause-effect model as the information flow framework to assess community vulnerability and risk perceptions throughout the semi-structured interview process. The focus was on how the community risk perceptions were shaped in the context of social amplification of risk in responding to climate change. This methodological approach underscores community risk perceptions are an inherent part of the decision-making process and helps enhance adaptive actions of flood-prone communities. The study also underlined the risk communication in groups and social networks that contribute to integrating structural and non-structural measures to advance understanding of community risk perceptions of future climate.

(Gotham, Campanella, Lauve-Moon, & Powers, 2018) This article investigates the determinants of flood risk perceptions in New Orleans, Louisiana

(United States), a deltaic coastal city highly vulnerable to seasonal nuisance flooding and hurricane-induced deluges and storm surges. Few studies have investigated the influence of hazard experience, geophysical vulnerability (hazard proximity), and risk perceptions in cities undergoing post-disaster recovery and rebuilding. We use ordinal logistic regression techniques to analyze experiential, geophysical, and sociodemographic variables derived from a survey of 384 residents in seven neighborhoods. they found that residents living in neighborhoods that flooded during Hurricane Katrina exhibit higher levels of perceived risk than those living in neighborhoods that did not flood. In addition, findings suggest that flood risk perception is positively associated with female gender, lower-income, and direct flood experiences. In conclusion, we discuss the implications of these findings for theoretical and empirical research on environmental risk, flood risk communication strategies, and flood hazards planning.

(Wang, Wang, Huang, Kang, & Han, 2018) In the flood-prone city of Jingdezhen, flood disaster is one of the most destructive natural hazards to impact society and the economy. Understanding and improving public flood risk perception is conducive to implementing effective flood risk management and disaster reduction policies. However, few studies have been attempted to focus on public flood risk perception in small and medium-sized cities in China, like Jingdezhen. Therefore, this study aimed to investigate the public flood risk perception in four districts of Jingdezhen and examine the related influencing factors. A questionnaire survey of 719 randomly sampled respondents was conducted in 16 sub-districts of Jingdezhen. Analysis of variance was conducted to identify the correlations between the impact factors and public flood risk perception. Then, the flood risk perception differences

between different groups under the same impact factor were compared. The results indicated that the socio-demographic characteristics of the respondents (except occupation), flood experience, flood knowledge education, flood protection responsibility, and trust in government were strongly correlated with flood risk perception. The findings will help decision-makers develop effective flood risk communication strategies and flood risk reduction policies.

(Thongs, 2019) in this study, Trinidad's flood risk management challenges have been observed, and a solution for better flood risk management has been assessed. Flooding is the most recurrent and severe problem for Trinidad. Trinidad's economy started shrinking from 2013-to 2017 after the drop in oil prices. They had a very costly disaster management plan which needed to stop after the budget cuts. They started communicating the problem and risk to the people through various advertisements and workshops. They noticed that when the people realized that their government could not cater to the needs of every flood-affected person, people started taking measures to prepare themselves for the floods. They realized that their goal of effective, efficient, comprehensive, and sustainable disaster risk reduction initiatives could not be achieved only by quantitative techniques. A mixture of qualitative knowledge and quantitative methods can help achieve their goals. In this study, a methodology for integrating both the quantitative and the qualitative methods has been presented. The results obtained showed that this integration of the quantitative and the qualitative methods positively aided the disaster risk reduction practices.

(Roder, Hudson, & Tarolli, 2019) Veneto region, located in the northeastern part of Italy, is the third richest region in Italy. Veneto is also the most occupied and

economically competitive urban landscape of Europe, with Venice being the capital city of this region. Out of all the losses caused by natural hazards, third is caused by floods in Europe. The flooding events cause millions of euros' damage which has a bad impact on the economy of this region. So, there was a very strong need to limit the flood impacts. It was expected the impacts of the floods would grow in the future due to the influence of climate change and socioeconomic development. They realized that it was important for everyone living in the flood-prone areas to adopt property level flood risk management. which would also be in line with the Sendai framework for disaster risk reduction and the sustainable development goals. An online survey asked people about the risk perceptions, preparedness, and willingness to pay for flood insurance. The results showed that the flood risk knowledge was high but not enough for proactive risk management people seemed reluctant towards insurance, but a compulsory insurance system seemed acceptable. The premiums ranges were within the estimated prices; other areas were also identified, which can be critical for disaster risk management policies and supporting the insurance companies for better property-level risk management.

(Walkling & Haworth, 2020) Flood risk communication strategies have been ineffective for older adults as they have failed to accommodate diversity, viewing retired populations as homogenous. There have been calls from academics and NGOs to develop more detailed understandings of older adults' risk experiences to inform disaster risk reduction DRR and communication approaches. They conducted in-depth interviews of twelve members of the retired population, to discover risk perceptions, coping capacities, risk communication and their preferences of the risk communication medium. Results present retired population is a diverse group with

varying perceptions and capacities. While personal risk perceptions were low overall, coping capacities varied and were primarily social in nature, which can be sustained despite mobility or other limitations typical of older age. Participants expressed a preference for traditional/interpersonal risk communication methods, such as telephone calls or home visits. A key recommendation from this study is that risk communication and DRR practices should adopt people-centric approaches co-produced and respect the differentiated vulnerabilities, capacities, and needs of at-risk populations. This study and its findings are important in providing a more nuanced picture of the vulnerabilities and capacities of the particularly at-risk population of older adults. We must ensure that future DRR research, policies, and practices focus on all experiences of at-risk populations, not only the dominant narratives or extremes of groups, to capture differences within groups' abilities to support more effective community DRR.

(Netzel, Heldt, Engler, & Denecke, 2021) Heavy precipitation events are expected to increase in frequency and intensity in many parts of Europe due to climate change. These events can affect regions located far from rivers that have never been affected before. As warning times are short, there are hardly any effective emergency measures to mitigate the severe damage caused by pluvial floods. Therefore, long-term mitigation measures are necessary for sustainable urban flood management. However, people first need to realize their personal risk to become active and take private precautionary measures. To better understand the processes underlying public risk perception of pluvial floods, a questionnaire-based telephone survey was conducted analyzing two case studies in western Germany. Key findings reveal that risk perceptions need to be distinguished between personal and global

perceptions. Personal risk perception was low among the participants, while their global risk perception was far higher. The determinants of global and personal risk perception on pluvial flooding were identified. The study also showed that mitigation behavior is influenced by personal risk perception, knowledge, education, and housing conditions. When future risk communication and flood management strategies are developed, these determinants should receive attention.

2.3.2 Risk communication case studies

(Eisenman, Cordasco, Asch, Golden, & Glik, 2007) This is a qualitative study among the hurricane Katrina evacuees to understand better the factors that influenced their evacuation decisions in the minority communities most affected by the catastrophic Hurricane Katrina in Houston. This study finds out that the participants were mostly African America with low incomes and were from New Orleans. The participants had strong ties to extended family, friends, and community groups that influenced the evacuation decisions. Other factors, including transportation, shelter access, and perception of the evacuation message, also influenced the decision-making to evacuate. This study also found out that social connections facilitated or hindered evacuation decisions. In the end, this study suggests that only removing the most apparent barriers like transportation and shelters is not enough for improving disaster plans. The effective disaster plan should account for the extended family influence and the social networks for better community-based communication and preparation strategies.

(Martens, Garrelts, Grunenberg, & Lange, 2009) This study examined the effects of a new flood risk communication technique that took the diversity of all the citizens into account and seemed promising in closing the information gap in risk

communication, which can result in misleading citizens. In this study, they have taken Bremen, a city in Germany, as their case. The analysis has been done on two levels. One is meso level in which the differences in the residential situation have been analyzed. The second is micro-level, in which the risk perceptions and the protective actions that the people can take have been analyzed. The data collected from the population is used to what type of actions the people will take to protect themselves from the flood risks and how much they are prepared against the floods. They developed a computer-based information system prototype. They further emphasized that these types of techniques can only be done effectively by analyzing the residential situation differences of the people. This analysis gives better insight into the vulnerability, which can be proved effective for distributing flood risk information to the citizens. They recommended that the government shake hands with non-governmental organizations that can act as moderators between the government and the people.

(Yamada, Kakimoto, Yamamoto, Fujimi, & Tanaka, 2011) In this study, they have said that the engineering has worked in flood mitigation practices for the last two decades, but the flooding threat is still present, so they need to build more flood-ready communities. So, they need to strengthen the local flood disaster mitigation by participatory approaches for community-based flood risk communications. In this study, the risk communication for the floods because of the heavy rains and the river flooding was carried out in the Kumamoto city of Japan during 2006 and 2007. They developed the community-based flood hazard and evacuation map, which was verified on virtual desktop evacuation drills and analyzed with respect to the timing of the announcement of evacuation, walking speed during

evacuating, and the location of the evacuation centers. Implementing these flood risk communication techniques was found to be effective for increasing people's awareness for both self and mutual help in community-based flood risk mitigation.

(Stewart & Rashid, 2011) in this study, the gaps in risk communication are identified, and the generation of a plan of action to improve the information sharing, bottom-up approach, and partnership development has been discussed because, after more than 10 years' of the red river floods, vulnerability to future flooding events and the lack of flood risk communication still existed. They used diversified techniques involving interviews, flood plain surveys, and decision maker's risk management workshops. Their study found that there is significant pressure employed by regional flood plain policies that limit risk communication and affect the social vulnerability in rural flood-prone areas. The ability of the communities to address flood risks has been impacted, which has increased the local risk, and the cooperation of the communities has been decreased due to the failure of the top-down approach in flood risk management. This study recommends policies that compensate for the gaps in risk communication and the development of partnerships between communities.

(Shepherd & van Vuuren, 2014) This is qualitative research conducted to explore the actions and experiences of the immigrants and refugee's communities during the flood of 2011 in Brisbane. In this research, semi-structured interviews were taken from cultural and linguistically diverse gatekeepers who performed very important roles in flood response in 2011. This study suggests that there is a censorious gap present in understanding the cultural and linguistic diverse community response to natural disasters and the socio-demographic characteristics

of the people that affect the gatekeeper's behavior. The limitation of this study is that it does not consider the factors like trust in government, gender, and the warning confirmation, which affects the behavior of the gate keepers, and the small number of the gatekeepers who agreed to be interviewed makes the implications limited. This study found the attributes and demographics of the cultural and linguistic diverse gate keepers and how they used the sources relating to their participation in the communities and their interpersonal sources to gain the information and the use of media to convey the information.

(Ping, Wehn, Zevenbergen, & Van Der Zaag, 2016) In this study, the author has said that the flooding cannot be stopped regardless of all the progress being made in the engineering flood mitigation works. It is a huge and progressing challenge. This understanding gave rise to changing the flood risk management from relying mostly on structural measures to non-structural initiatives. The risk communication accommodating the variation present in the communities throughout the disaster cycle is one of the examples of non-structural flood risk management measures. They observed that the communities with better flood risk perception are better in preparing, responding, mitigating, and recovering from the harmful effects of floods or any other disasters. This study also investigates the present flood risk communication operation in Doncaster, United Kingdom. They identified the helpful and dismissive factors towards flood risk communication practices and making a community more resilient against floods. In the end, they gave recommendations to refine the flood risk communication so it can be better targeted and used throughout the disaster life cycle to increase community resilience.

(Binh, Zhu, Groeneveld, & van Ierland, 2020) After the devastating flood in 2000, the government of Vietnam constructed dykes in the Mekong Delta to protect the public and the crops. After the construction of dykes, the farmers and people developed a false sense of security that these dykes were enough to save them and their crops from floods, but literature was showing. Otherwise, it was very necessary to communicate the risk to these people. They tried people-centered risk communication, which was more effective than formal risk communication. This informal risk communication had some psychological effect that the household perceived better risk and took nonstructural protective measures. Furthermore, they noticed that the participation of women in this risk communication practice did not affect the intentions of the male household heads to take mitigation measures. In conclusion, they discussed that risk communication should focus on coping capacities for financial measures and address the problem with wishful thinking for flood-prone households.

(Shrestha et al., 2021) In this study, the Ratu watershed in Nepal has been taken as a case study. Nepal experiences frequent floods and landslides, especially in the Monsoon season. In the last decade, the early warning systems established in Nepal have been proved efficient to reduce the number of affected and killed people by floods. However, it has been observed that there are still significant challenges in communicating flood warnings to the most vulnerable people. The absence of live monitoring in smaller streams and canals generated significant difficulties for communicating early warnings. The multilevel governance system also creates difficulties like lack of efficient coordination between relevant agencies, shortage of competent people, limited budget, vague roles, and responsibilities. They used the

Alexander framework to pick out gaps in their early warning communication system and their technical, institutional, and socio-cultural components. The qualitative research method was used in key informant interviews, and on-site focus groups discussion was conducted at the local, district, and national levels to collect data. They found out that sociocultural features need to be strengthened to make early warnings accessible to the most vulnerable, and the warning messages need to be improved for proper interpretation. In the end, the flood risk communication must take account of the socioeconomic and political experiences in both the content and the delivery of the information.

(Cayamanda & Paunlagui, 2020) This qualitative study consists of document analysis and the examination of the interviews taken of the heads and the representatives of the identified agencies involved in risk reduction and disaster management. The Davao City in the Philippines has faced catastrophic floods, which posed the need to build resilience among the communities to act properly during the time of floods and to minimize the negative impacts of the floods. This study suggests that the policy makers must review and update their existing policies to promote effective community engagement and resolve the gaps in their policies. This study found out that Davao city has a top-down risk communication system with no interaction between the message sources and the communities. Also, the messages are unfiltered and very hard to interpret. This study proposes that a participatory management model for flood risk communication needs to be implemented to communicate and reduce flood risk for vulnerable communities effectively.

CHAPTER 3

Methodology

3.1 Study Area Profile

The study area is Samina Saadat and its surrounding rural areas. Which is a town and a union council located in district Dera Ghazi Khan of Punjab province Pakistan. It is located on the western bank of the Indus River, as shown in the figure below. Like most rural areas, the town of Samina Sadat lacks the basic infrastructure for the livelihood of its population. The condition of roads is poor. There is no suitable rural health unit in this area. There is no proper sewage or water supply system. They lack secondary or higher secondary schools. The people of Samina Saadat must come to the city Dera Ghazi Khan almost 20 km away, for any medical emergency, transportation, schools, colleges, business, or shopping. This area experience floods every year, and people lose their crops, houses, cattle, and in rare cases, their lives. Most of the people living in this area are poor, and they tend to move closer to the riverbank due to the lower cost of land. Most people living in this area do not have access to electricity. Hundreds of people live in huts built in the dry parts of the riverbed. Some people grow their crops in the riverbed and others very close to the riverbank right behind the embankments. In short, most people live in very critical conditions and are very vulnerable to floods.

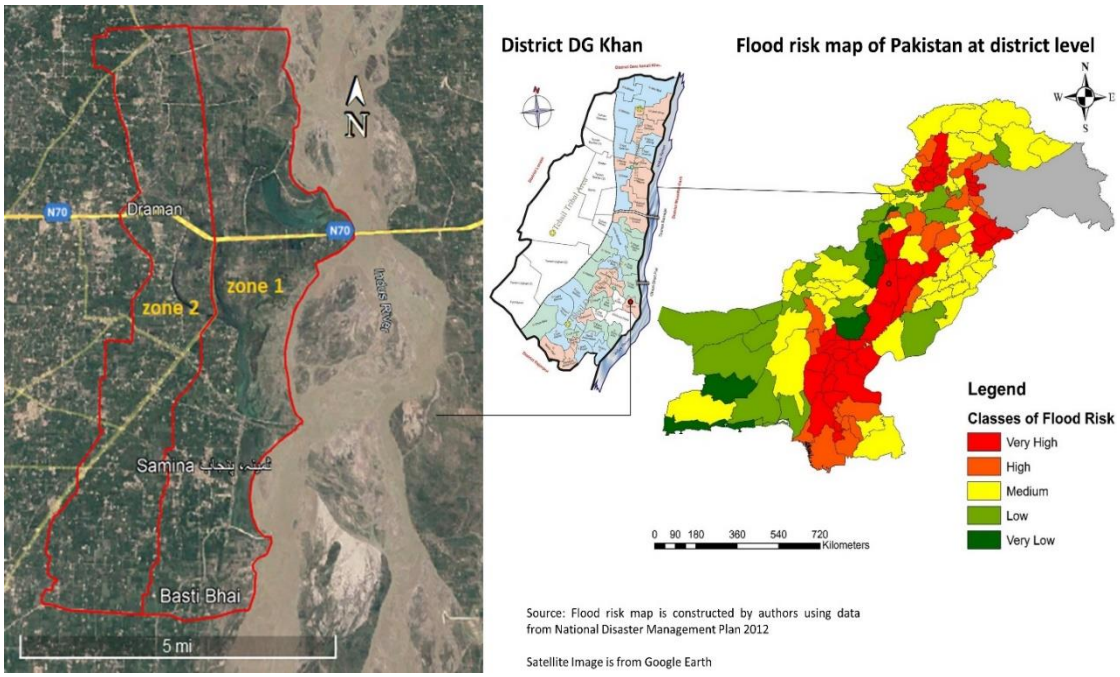

Figure 3 Study area profile

3.2 Floods in Pakistan

Same as all the other countries of the world, climate change and global warming are affecting Pakistan, making Pakistan one of the most flood susceptible countries in the world. The climate and Pakistan's topography play a crucial role in making Pakistan vulnerable to floods. The presence of the highest mountain ranges in the northern part of the country accumulates glaciers in winter. In summer, the melting of those glaciers substantially increases the water flow in the rivers to top it all off from July to September. The monsoon season hits Pakistan. The monsoon season brings a humid climate and torrential rainfalls to the region. The rivers already flowing with a lot of water when the rainwater is added in them causes floods. The rains from the monsoon cause flash floods, urban flooding, and riverine floods. Experts believe the changes in monsoon patterns are the main reason cause flooding in Pakistan (Qasim et al., 2015).

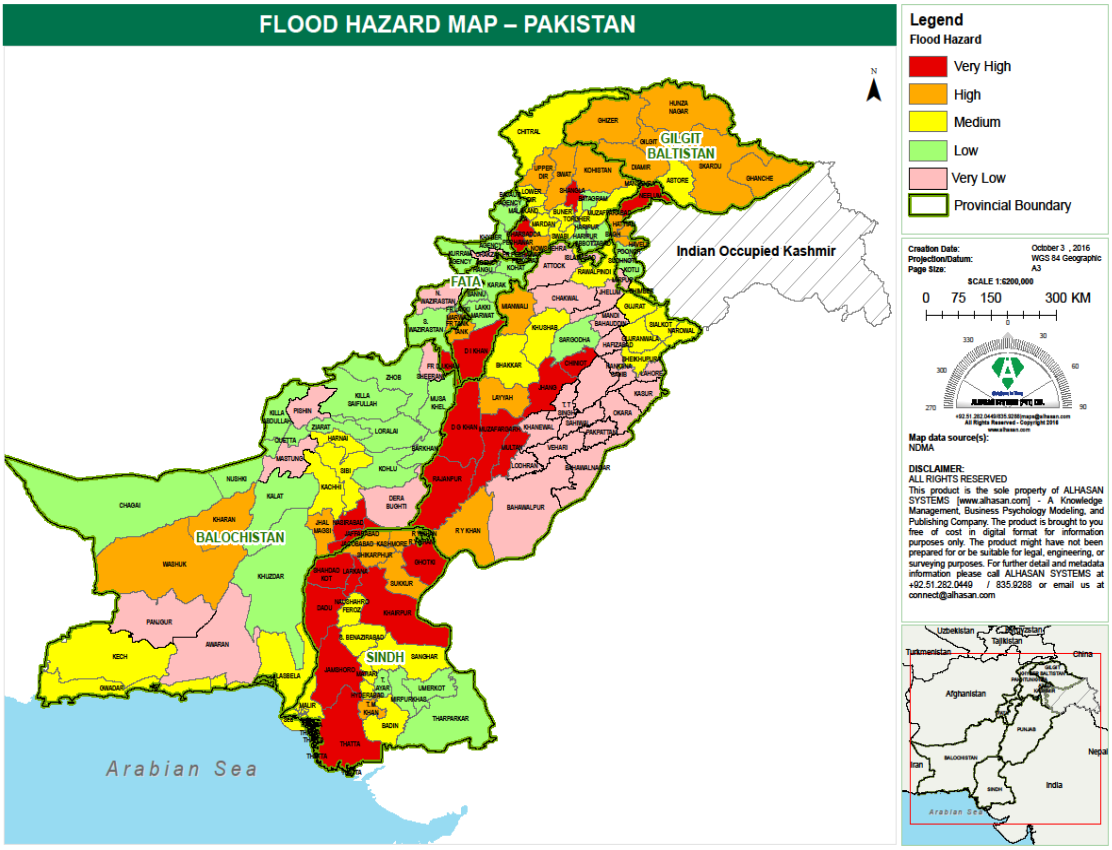

Figure 4 Pakistan flood hazard profile

In the previous century, Pakistan has endured 67 traumatizing floods. Apart from these floods, Pakistan faces river flooding almost every year, taking the lives of humans and animals' lives and causing severe damage to public properties, agricultural lands, and government infrastructures (Khan, 2011). In the previous 70 years, 25 major flooding events have claimed the precious lives of nearly 12,502 people, destroyed almost 197,273 villages, and affected an area of 616,598 km^2. The flood of 2010 was the most devastating flooding event in the history of Pakistan (COMMISSION, 2017). The flooding event of 2010 has caused financial losses of nearly 10 billion USD, claimed the lives of almost 1985 people, affected 17553 villages, and affected an area of 160000 km^2 (Qasim et al., 2015). It is the most catastrophic river flood ever to hit Pakistan.

3.3 Dera Ghazi Khan Profile

Dera Ghazi Khan is one of the biggest administrative divisions of Punjab province with respect to the area. The area of Division Dera Ghazi Khan is about 38778 km², and according to the census of 2017, 11,014,398 people live in this division. The four districts of the Dera Ghazi Khan division are District Dera Ghazi Khan, District Layyah, District Rajanpur, and District Muzaffargarh. The Indus River Passes from the middle of the Dera Ghazi Khan Division. The whole division is disaster-prone, as shown in the figure below.

District Dera Ghazi Khan has a population of around 2,872,201. According to the census of 2017, almost half of this population is rural population. The District Dera Ghazi Khan is a very underdeveloped district in Punjab province, especially the rural areas that lack the suitable infrastructure for the livelihood of its population.

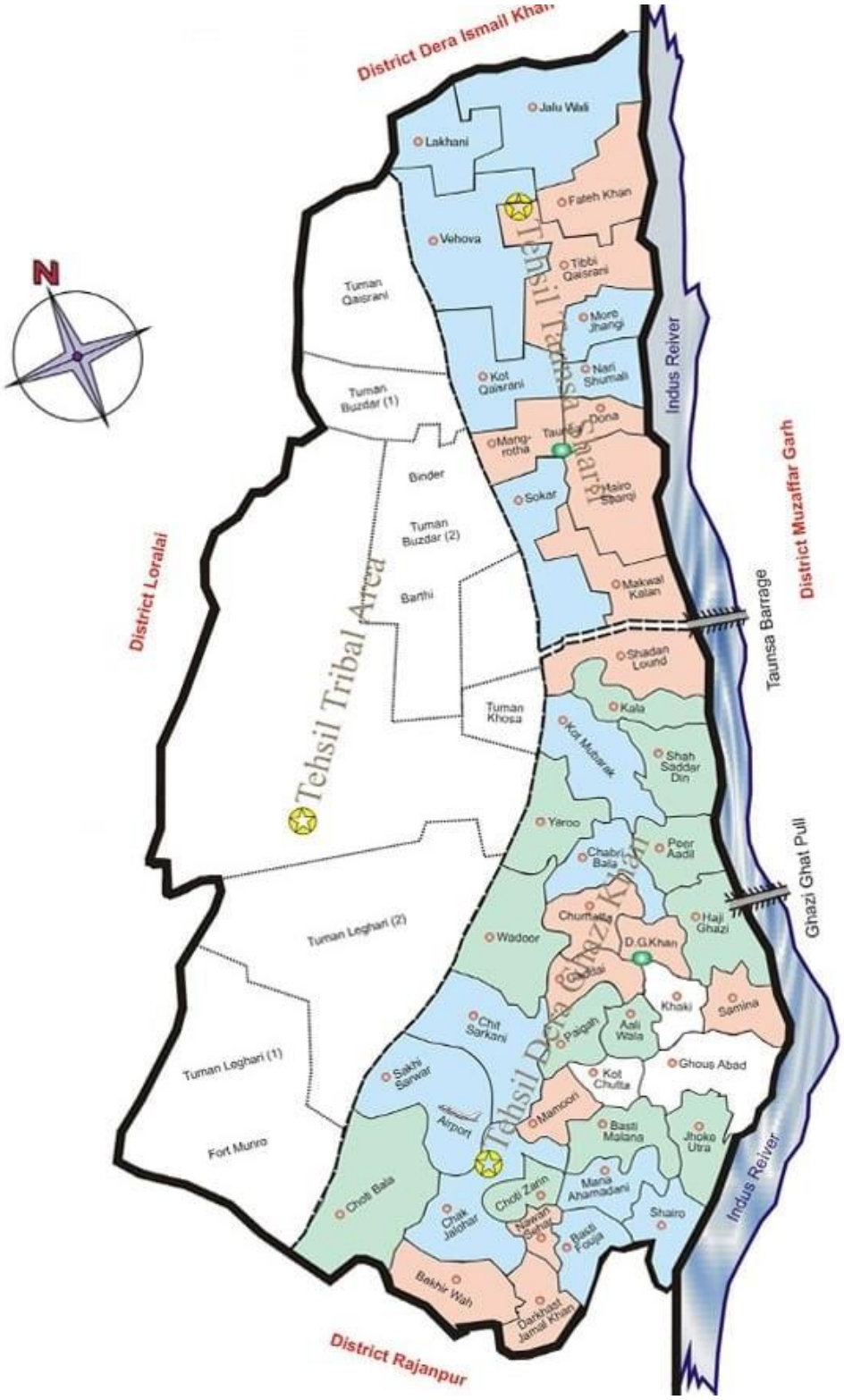

Figure 5 Dera Ghazi Khan District profile

3.4 Sampling and Data Collection

In this research, the data has been collected so that from zero to 5 km distance from the river bank, the responses of the people have been taken. The union council Samina Saadat has a population of around 10,000 people taken from the local government office. It was easy to calculate the sample size of the people living in Samina Saadat. Still, some areas did not lie in the Samina Saadat region but were severely affected. It was estimated around 2500 to 3000 people were living in such areas, so for sample size, it was decided to take the population of 14000 to be on the safe side. Slovin's formula for the sample size calculation was used to calculate the sample size of the population, with a margin of error was 5%, and the confidence level was 95%. For the estimated population, the sample size was 374. The responses of 420 people were taken for being on the safe side.

$$n = \frac{N}{1 + N(e)^2}$$

Here n is the sample size used for analysis, N is the estimated population of the study area (14000), and e is the level of precision (0.07).

Interview questions were designed to ask the officials of the government institutions which deals with the floods in the study area. Two officials of each of the following departments were interviewed about their department's technical, financial capacities: (1) irrigation department (2) agricultural department (3) local government (TMA) (4) Rescue (5) Provincial disaster management authority. The officials were asked about their department's technical capacity, human resource, manpower, financial capacities, the challenges they face in flood risk reduction, and their suggestions for improving the flood risk reduction practices.

3.5 Selection of indicators

A detailed literature review selected and shortlisted indicators related to risk perception. A total of 27 indicators were selected for measuring the risk perception of the people. All the indicators were grouped into four categories, i.e., 1) dread and fear, 2) attitude and behavior, 3) awareness and knowledge, and 4) reliability. The categories and their selected indicators are presented in the table below.

Table 1 Risk perception Indicators

Dread and fear	
RP 1	Perceived likelihood of flood
RP 2	Perceived dread or fear
RP 3	Perceived threat to life
RP 4	Increased occurrence
RP 5	Perceived danger to neighbors
RP 6	Concern about human interaction with floods
RP 7	Expected flood damage
RP 8	Value of the property
RP 9	Fear based on current knowledge
Attitude and behavior	
RP 10	Perceived ability to cope
RP 11	Perceived harmful effects that can be reduced
RP 12	Supplies interruption
RP 13	Changes in relationships
RP 14	Adapting lifestyles
Awareness and knowledge	
RP 15	Perceived extent of familiarity
RP 16	Perceived extent of knowledge about rescue and evacuation protocols
RP 17	Perceived settlement protection
RP 18	No dyke protection
RP 19	Knowledge about emergency protocols
RP 20	Perceived awareness of climate change

RP 21	Perceived understanding of flood cause
Trust	
RP22	Trust in information received from different sources
RP23	Trust in disaster management agencies
RP24	Trust in disaster management policies
RP25	Trust in the emergency plan of the government
RP26	Trust in government policies

The indicators related to risk communication were selected with the help of a thorough literature review, and all of the indicators were selected from these referred studies (Organization, 2020; Sato et al., 2020). The selected indicators were categorized into three categories, i.e., 1) Ease of understanding, 2) Accuracy, and 3) Trust, as shown in the table below.

Table 2 Risk communication indicators

Ease to understand	
RC 1	Announcements on radio
RC 2	Announcements on television
RC 3	Announcements on text messages
RC 4	Announcements on mobile speakers
RC 5	Announcements through pamphlets
Accuracy	
RC 6	Accuracy of radio broadcasts
RC 7	Accuracy of television broadcasts
RC 8	Accuracy of text messages
RC 9	Accuracy of mobile speakers
RC 10	Accuracy of pamphlets
Reliability	
RC 11	Reliability of radio, television etc.
RC 12	Reliability of NDMA, PDMA, local government
RC 13	Reliability of community members, local representatives
RC 14	Reliability of rescue, police

3.6 Questionnaire formulation

One type of questionnaire was designed for this study, which was taking the people's responses regarding the risk perception and risk communication on the Likert scale along with their socio-demographic characteristics and the effectiveness of modes of communication at the time of floods. The interview questions were asked from the officials of different departments involved in the disaster risk reduction practices in the study area. After a meticulous literature review for checking the risk perception, four categories were identified. For all these categories, indicators were identified and selected. For the selected indicators, questions were proposed and finalized. For checking the effectiveness of risk communication, the indicators were identified with the help of a thorough literature review. As risk communication plays a very important role throughout the disaster risk management cycle, the effectiveness of the risk communication was checked on the response phase of the disaster management cycle as the responses are more accurate at this stage. After selecting the indicators, questions were proposed and finalized. The interview questions were designed to ask the officials after literature review and after taking the responses from the people. When taking responses from the people, we got some ideas for the interview questions. Those questions were also included in the questionnaire and asked in the official interviews.

3.7 Data Analysis Technique

The effectiveness of modes of communication was checked by analyzing the percentages of people receiving the warning transmissions or announcements from each mode at the time of floods, which gave insight on which mode of

communication is more effective than the other. After successfully completing data collection, the respondent's profiles were made in both near and far zones with respect to their gender, age, qualification, house ownership status, employment status, past flood experience, household size, monthly income, and employed people at home. Then the average values of every indicator of risk perception were calculated along with their chi-square and significance values. Results were drawn from these values, highlighting the determinants of risk perceptions. The average value of all the indicators of risk communication was calculated on both areas along with their chi-square and significance values, which were compared in both zones, and later results were drawn. A correlation matrix of the respective risk perception and communication indexes was formed to check the correlation between the indexes. After comparing and analyzing the results, conclusions and recommendations were presented.

3.8 Summary of chapter

After the selection of the study area, a detailed questionnaire survey was conducted in two zones. One was in proximity to the river, and the other was in far proximity from the river. The data obtained from the questionnaire survey was then analyzed and compared on SPSS. Respondent profiles were constructed, and the tests used in the data analysis were crosstab analysis, linear regression, and correlation. The results gave us a clear understanding of the risk perception and communication of the people living in close and far proximities from the river. The determinants of risk perception and communication were analyzed. 10 in-depth interviews from the officials of the departments concerned with flood management

and response and rescue were also conducted. The interviews gave us insight into the current flood risk reduction practices and the challenges they face for the smooth running of their operations.

3.9 Methodology flowchart

The detailed research methodology is given in the flow chart below.

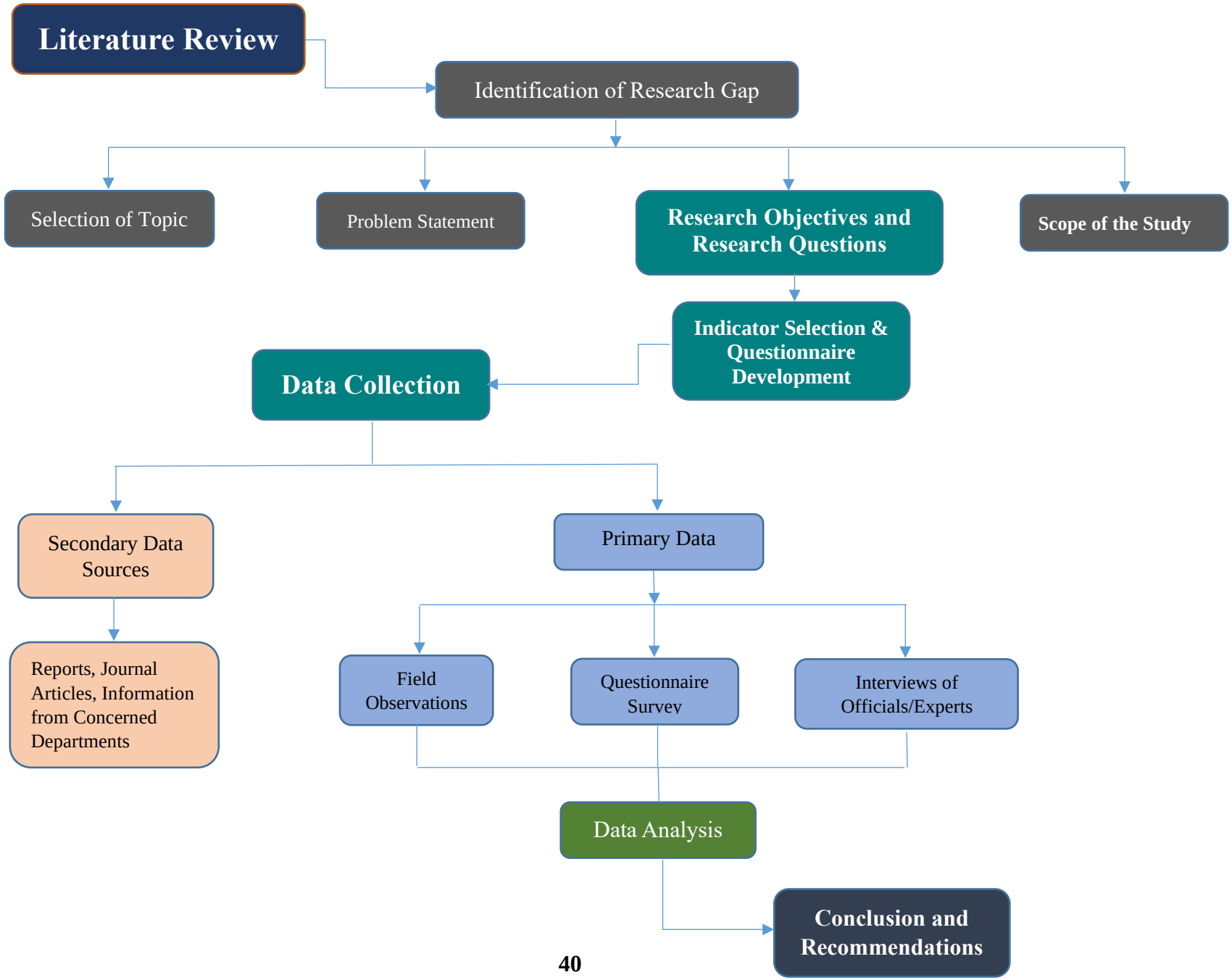

Figure 6 Methodology Flowchart

CHAPTER 4

Results and Discussions

Respondents Profiles

The responses of the people have been taken in two zones with respect to their distance from the river, as discussed earlier. The data presented here is with respect to zones. The socio-demographic characteristics of the respondents are shown in the figure below and discussed in detail in the forthcoming section.

4.1 Gender of the respondent

In this study, 41.7 % of the responses are taken from females, and 58.3% are male responses. In zone 1, 26% of responses are from males and 18.8% of the responses are taken from females. Similarly, in zone 2, 32.3% are male, and 22.9% are female responses. The chi-square and the significance values indicate that there is no significant difference.

Table 3 Gender of respondents

		Zone 1		**Zone 2**		**$\chi 2$**	**P**
		frequency	**%**	**Frequency**	**%**		
Gender	Male	109	57.9	136	58.6	0.018	0.894
	Female	79	42.1	96	41.4		

The frequencies of the gender of the respondents in both zones are shown in the figure below.

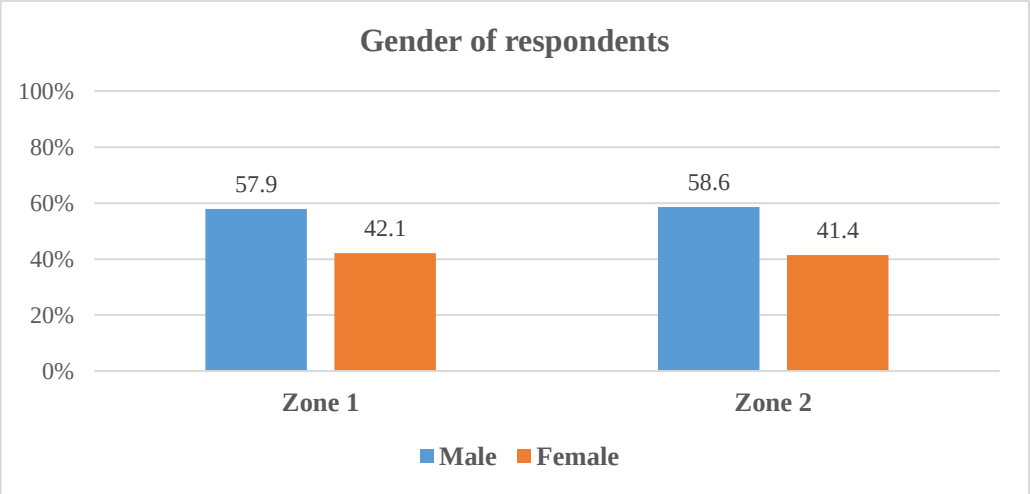

Figure 7 Gender of respondents

4.2 Qualification of the respondent

In the table below, the qualification of the respondents is shown. In zone 1, 13.6% of people were under matric, 16.4% people were matric qualified, 9.8% were graduates, and 5% people had masters or higher qualifications. In zone 2, 28.8% of people were under matric, 15% were matric qualified, 10.2% were graduates, and 1.2% people had masters or higher qualifications. So, a total of 42.4% population were under matric, 31.4% were matric qualified, 20% were graduates, and 6.2% of respondents were masters or higher qualified. The chi-square and the significance values indicate there is a significant difference.

Table 4 Qualification of respondents

		Zone 1		Zone 2		χ^2	ρ
		frequency	**%**	**frequency**	**%**		
Qualification	Under matric	57	30.3	121	52.2	28.885	0.000
	Matric	69	36.7	63	27.1		
	Graduate	41	21.8	43	18.6		
	Higher	21	11.2	5	2.1		

The graphical expression of the socio demographic character qualification of the respondents in shown in the figure below.

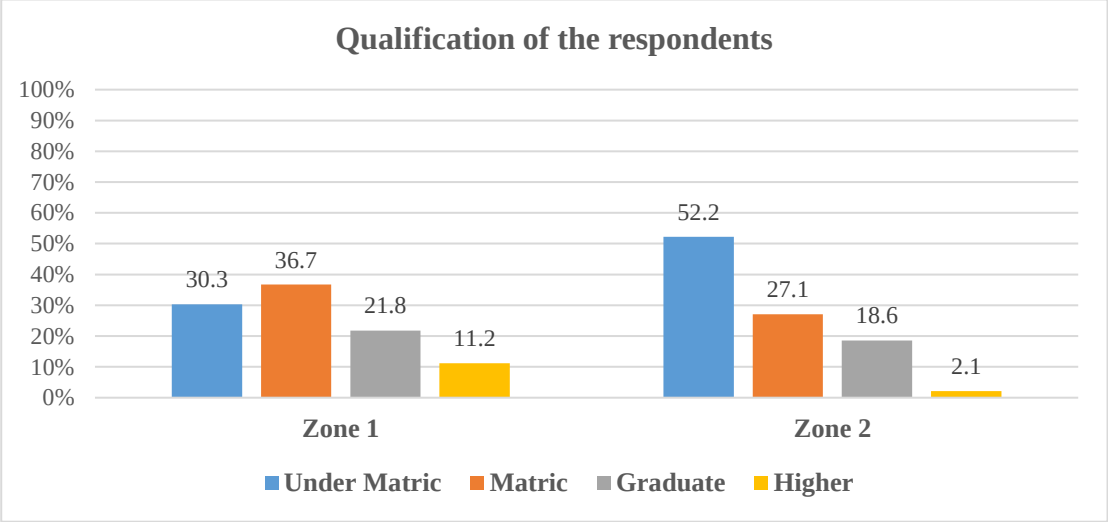

Figure 8 Qualification of respondents

4.3 Employment status of the respondent

In the selected sample, 65.2% of people were employed, and 34.8% of people were unemployed, further breaking it into the locations the zone 1 had 31.2% employed and 13.6% un-employed respondents, and zone 2 had 34% employed and 21.2% un-employed population. The chi-square and the significance values indicate that there is no significant difference.

Table 5 Employment status of respondents

		Zone 1		Zone 2		χ^2	ρ
		frequency	**%**	**frequency**	**%**		
Employment Status	Employed	131	69.7	143	61.6	2.962	0.085
	Un-Employed	57	30.3	89	38.4		

The frequencies of the employment status of the respondents are shown in the figure below.

Figure 9 Employment status

4.4 House ownership status of the respondent

The house ownership of the respondents is as follows, in zone 1, 35.7% of people owned their houses, and 9% had rental dwellings. In zone 2, 50.3% of people owned their houses, and 14% of people were living in rental houses. A total of 86% of people owned their houses, and 14% of people were living in rental houses. The chi-square value is 10.714, and the significance is 0.001, which shows there is a significant difference.

Table 6 House ownership status

		Zone 1		Zone 2		χ^2	ρ
		frequency	**%**	**frequency**	**%**		
House Ownership	Owned	150	35.7	211	50.3	10.714	0.001
	Rental	38	9.0	21	5.0		

The graphical representation of frequencies of the house ownership status of the respondents is shown in the figure below.

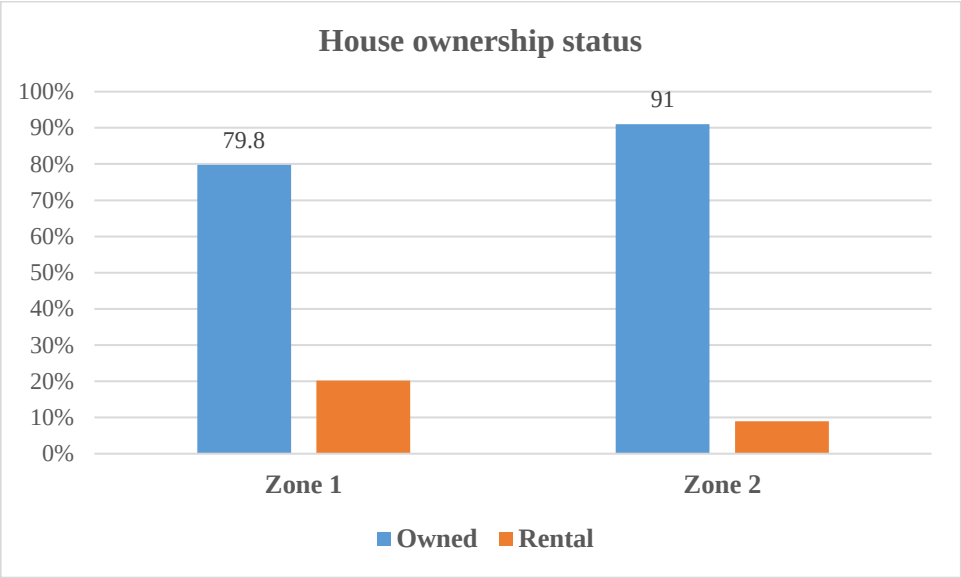

Figure 10 House ownership status

4.5 Past flood experience of the respondent

A total of 90.5% of people had past flood experiences, and 9.5% of people never experienced any flood. In zone 1, 35.7% of people had experienced floods in their lives, and 9% never experienced any flood in their lives. In zone 2, 54.8% of people had past flood experiences, and 0.5% had no flood experience in the past. The chi-square value is 45.128, and the significance value is 0.000, which shows a significant difference.

Table 7 Past flood experience

		Zone 1		Zone 2		$\chi 2$	P
		frequency	**%**	**frequency**	**%**		
Past Flood Experience	Yes	150	35.7	230	54.8	45.128	0.000
	No	38	9.0	2	0.5		

The frequencies of past flood experiences of the respondents are shown in the figure below.

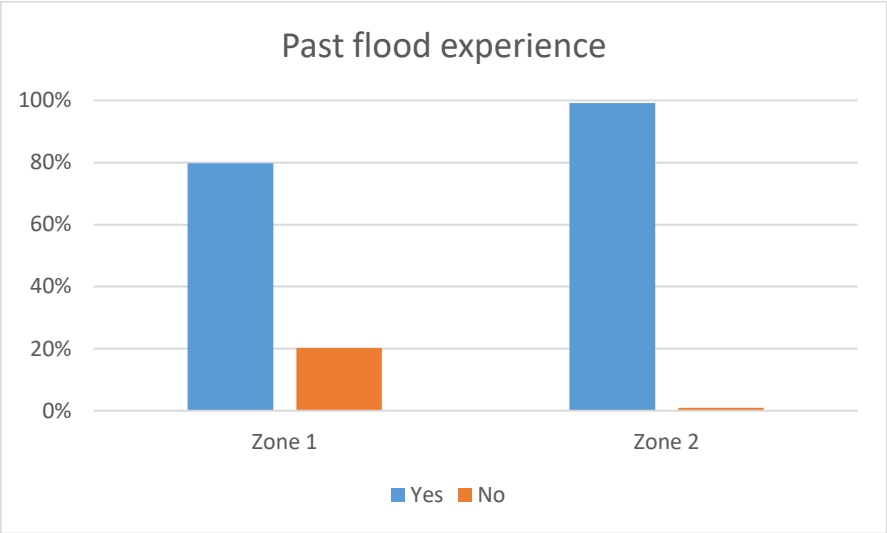

Figure 11 Past flood experience

4.6 Age of the respondent

The age groups of the respondents are as follows a total of 48.3% people were 30 or less than 30 years old, 40.5% people were 31 to 45 years old, 8.6% people were 46 to 60 years old, and 2.6% people were more than 60 years old. Out of these totals in zone 1, 21.4% people were 30 or less than 30 years old, 20.5% people were between 31 and 45 years old, 2.5% people were between 46 to 60 years old, and 0.5% people were more than 60 years old. Similarly, in zone 2, 26.9% of people were 30 or less than 30 years old, 20% were between 31 and 45 years old, 6.2% were between 46 and 60 years old, and 2.1% were more than people 60 years old. The average age of all the respondents in 33.69 years old with a standard deviation of 11.012. The chi-square value is 9.692, and the significance value is 0.021, indicating a significant difference.

Table 8 Age groups

		Zone 1		Zone 2		μ	σ	χ^2	ρ
		frequency	**%**	**frequency**	**%**				
Age (years)	30 or less	90	21.4	113	26.9	33.69	11.012	9.692	0.021
	31 to 45	86	20.5	84	20.0				
	46 to 60	10	2.4	26	6.2				
	60 or more	2	.5	9	2.1				

The graphical representation of the age groups of the respondents is shown in the figure below.

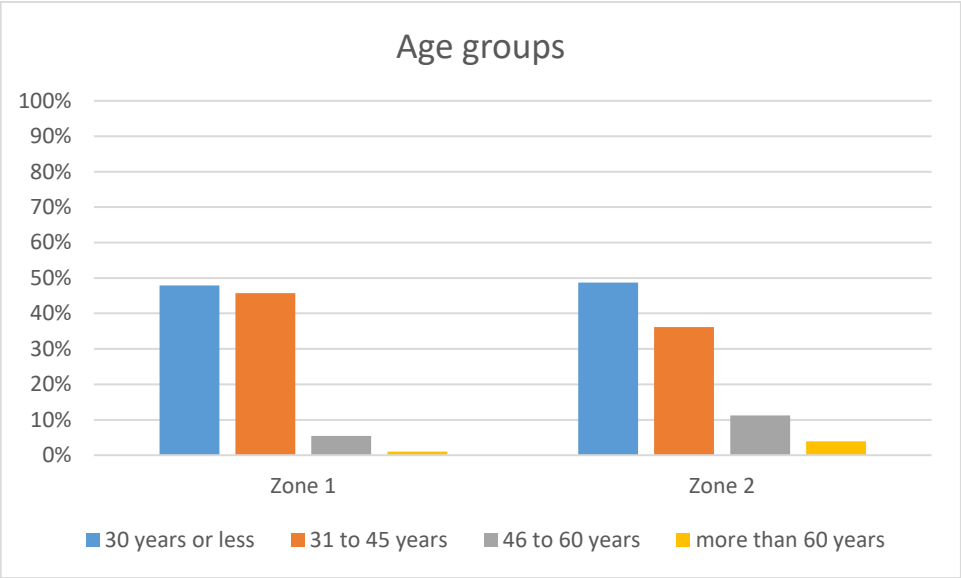

Figure 12 Age groups

4.7 Household size of the respondent

In the responses, it is observed that 28.5% of the people have a household size of 1 to 5 people, 55.5% people have a household size between 6 and 10 people. 15% of people have a household size of 11 to 15 members, and 1% have a household size between 16 and 20 people. In zone 1, 21.4% people have a household size between

1 and 5 people, 18.1% people have a household size between 6 and 10 people, 5% people have a household size between 11 and 15 people, and 0.2% people have a household size between 16 and 20 people. Similarly, in zone 2, 7.1% of people have household size up to 5 people, 37.4% people have a household size between 6 and 10 people, 10% people have a household size between 11 and 15 people, and 0.7% people have a household size between 16 and 20 people. The average household size of the respondents is 7.42 people, and the standard deviation is 3.287. the chi-square and the significance value indicate that there is a significant difference.

Table 9 Household size

		Zone 1		**Zone 2**		**μ**	**σ**	**χ^2**	**ρ**
		frequency	**%**	**frequency**	**%**				
Household Size	1 to 5 people	90	21.4	30	7.1	7.42	3.287	62.232	0.000
	6 to 10 people	76	18.1	157	37.4				
	11 to 15 people	21	5.0	42	10.0				
	16 to 20 people	1	.2	3	.7				

The frequencies of the household size of the respondents are shown in the figure below.

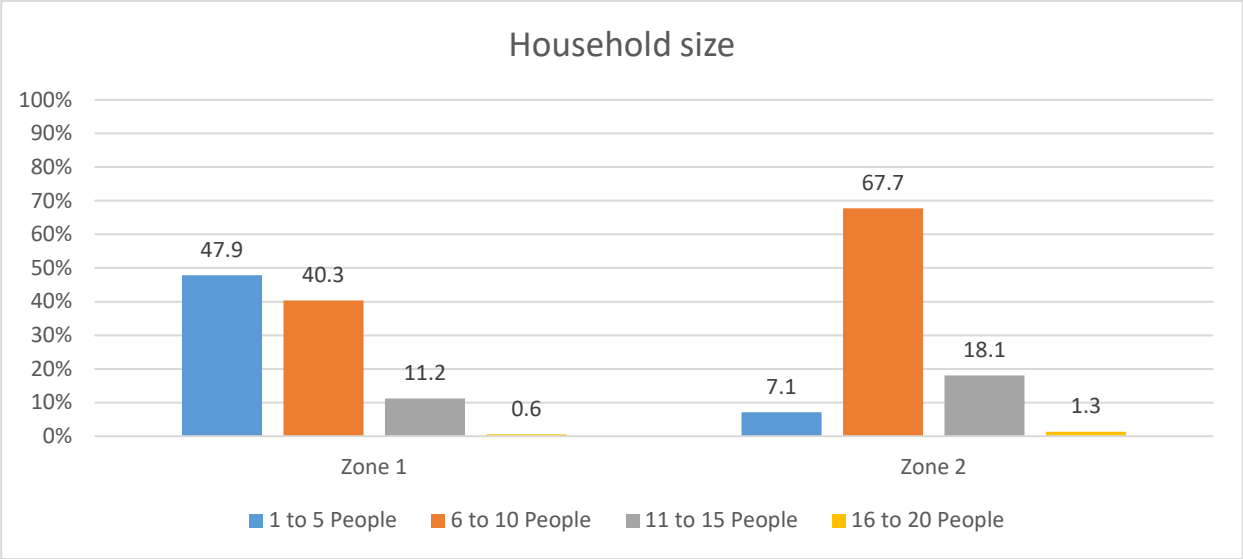

Figure 13 Household size

4.8 Monthly income of the respondent

The data shows that in zone 1, 9.3% people have income up to 20 thousand rupees, 17.1% people have their monthly income between 20 and 40 thousand rupees, 15.5% people have their monthly income between 40 and 60 thousand rupees, 1.9% people have their monthly income between 60 and 80 thousand rupees, 0.2% people have their monthly income between 80 and 100 thousand rupees and 0.7% people have their monthly income more than 100 thousand rupees. Similarly, in zone 2, 9.5% of people have their monthly income up to 20 thousand, 27.4% people have their monthly income between 20 and 40 thousand rupees, 12.1% people have their monthly income between 40 and 60 thousand rupees, 0.7% people have their monthly income between 60 and 80 thousand rupees, 3.1% people have their monthly income between 80 and 100 thousand rupees and 2.4% people have their monthly income more than 100 thousand rupees. The average income of the respondents is 43252.38 rupees, and the standard deviation is 56777.026 rupees. The chi-square and the significance values show that there is a significant difference.

Table 10 Monthly income

		Zone 1		Zone 2		μ	σ	χ2	ρ
		frequency	%	frequency	%				
Monthly Income (PKR)	0 to 20000	39	9.3	40	9.5	43252.38	56777.026	23.567	0.000
	20001 to 40000	72	17.1	115	27.4				
	40001 to 60000	65	15.5	51	12.1				
	60001 to 80000	8	1.9	3	.7				
	80001 to 100000	1	.2	13	3.1				
	More than 100000	3	.7	10	2.4				

The frequencies of the monthly income of the respondents are shown in the figure below.

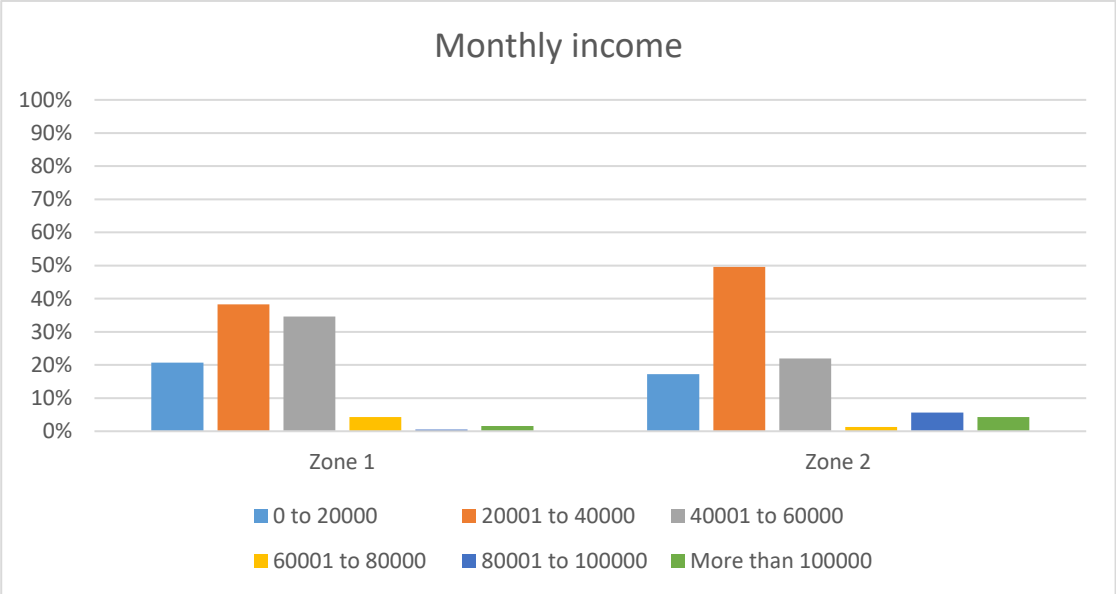

Figure 14 Monthly income

4.9 Employed people at home of the respondent

The data shows that there are 0.5% people who have no one employed at their homes, 22.1% people have 1 employed person at their homes, 43.3% people have two employed people at their homes, 22.9% people have 3 employed people at their

homes, 8.1% people have 4 employed people at their homes, 2.1% people have 5 employed people at their homes and 1% people have more than 5 employed people at their homes. In zone 1, 0.5% people have no employed people at their homes, 10.2% people have one employed person at their homes. 17.6% people have two employed people at their homes. 9.5% people have three employed people at their homes. 4.5% people have four employed people at their homes. 1.9% people have five employed people at their homes and 0.5 people have more than five employed people at their homes. Similarly, in zone 2, no one has un-employed at their homes. 11.9% people have 1 employed person at their homes. 25.7% people have 2 employed persons at their homes. 13.3% people have 3 employed persons at their homes. 3.6% people have 4 employed people at their homes. 0.2% people have 5 employed people at their homes and 0.5% people have more than 5 employed people at their homes. The average employed person at the home of all the data is 2.27 people, and the standard deviation is 1.055. the chi-square and the significance values indicate there is a significant difference.

Table 11 Employed people at home

		Zone 1		**Zone 2**		**μ**	**σ**	**χ^2**	**ρ**
		frequency	**%**	**frequency**	**%**				
Employed People at Home	0	2	.5	0	0.0	2.27	1.055	12.993	0.043
	1	43	10.2	50	11.9				
	2	74	17.6	108	25.7				
	3	40	9.5	56	13.3				
	4	19	4.5	15	3.6				
	5	8	1.9	1	.2				
	More than 5	2	.5	2	.5				

The graphical representation of a number of employed people at home is shown in the figure below.

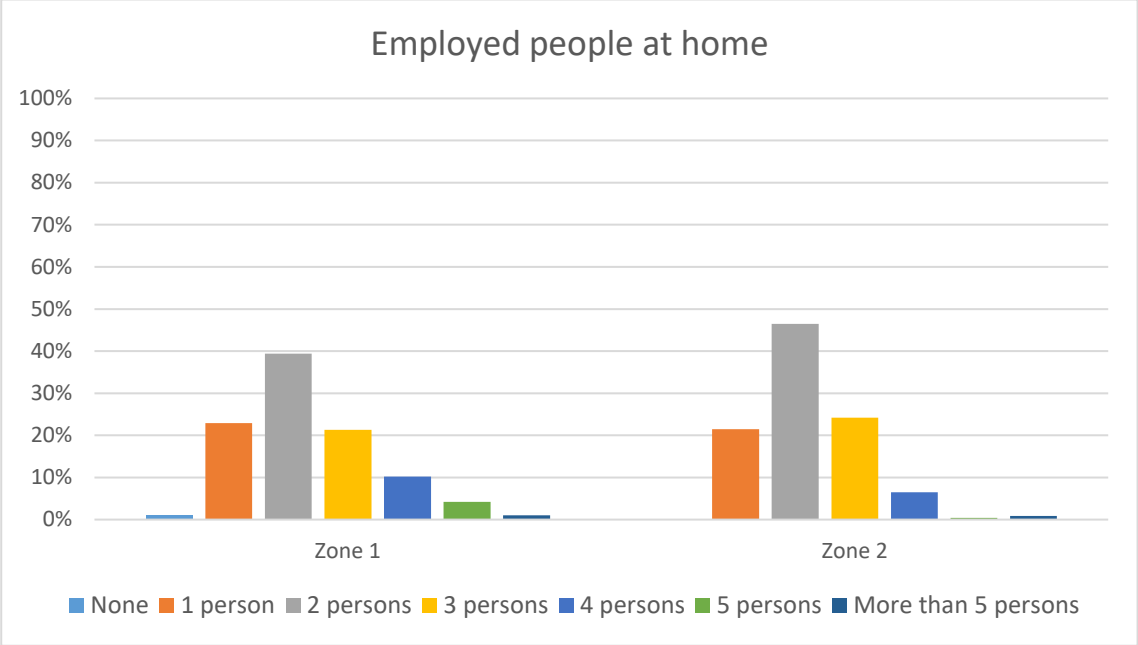

Figure 15 Employed people at home

CHAPTER 5

Risk Perception and its determinants

5.1 Fear index

The indicators in the dread or fear index of risk perception are shown in table 1 above. Fear is the most important component of risk perception studies because it drives the behavior of people towards floods. If a person is more afraid of floods, he will perceive more risk and prepare better. The average values of all the indicators in the Dread or fear index of risk perception are shown in the table below. Perceived likelihood of flood" has an average value of '3.154' and '4.366' in zone 1 and 2. It shows that more people living in zone 2 believe that there will be a flood this year. The data found a significant difference between the responses of people. Perceived dread or fear has an average value of '3.723' and '4.090' in zone 1 and 2. It indicates that people living in zone 2 are more afraid of floods. The study found a significant difference in the responses of people. Perceived threat to life has an average value of '3.441' and '4.107' in zone 1 and 2, it means that more people living in zone 2 are afraid that flood can take a life. The study found a significant difference in the responses of people. The indicator "increased occurrences" has an average value of '3.845' in zone 1 and '3.943' in zone 2. which shows that more people living in zone 2 believe that the frequencies of floods will be increased in the future. the chi-square and significance values of this indicator show that there is a significant difference in the responses of people. The indicator "perceived danger to neighbors" has an average value of '3.590' in zone 1 and '4.241' in zone 2. which shows that more

people in zone 2 believe that flood can inflict danger to their neighbors. the chi-square and significance vales of this indicator show that there is a significant difference between the responses of people. The indicator “human interaction with floods” has an average value of ‘3.170’ in zone 1 and ‘4.107’ in zone 2. Which shows that more people living in zone 2 believe that human activities can cause floods. the chi-square and significance values show that there is a significant difference between the responses of people. The indicator “expected flood damage” has an average value of ‘3.707’ in zone 1 and ‘4.155’ in zone 2. Which indicates that more people living in zone 2 believe that floods can cause substantial damages. the chi-square and significance value of this indicator shows that there is a significant difference between the responses of people. The indicator “value of the property (house)” has an average value of ‘3.319’ in zone 1 and ‘3.340’ in zone 2. Which indicates that more people in zone 2 believe that floods can damage their houses. the chi-square and significance values of this indicator show that there is no significant difference between the responses of people. The indicator “value of the property (crops)” has an average value of ‘3.744’ in zone 1 and ‘4.073’ in zone 2. Which indicates that more people in zone 2 believe that floods can damage their crops. the chi-square and significance values of this indicator show that there is a significant difference between the responses of the people. The indicator “fear-based on current knowledge” has an average value of ‘3.303’ in zone 1 and ‘3.892’ in zone 2. which indicates that more people living in zone 2 are afraid of the floods based on their current knowledge and understanding of floods. The study found a significant difference between the responses of the people.

Table 12 Dread or fear index of risk perception

Indexes and Indicators	Zone 1 (Avg)	Zone 2 (Avg)	Chi-Square	Significance
Dread or fear				
Perceived likelihood of flood	3.154	4.366	98.859	0.000
Perceived dread or fear	3.723	4.090	23.952	0.000
Perceived threat to life	3.441	4.107	48.598	0.000
Increased occurrence	3.845	3.943	28.291	0.000
Perceived danger to neighbors	3.590	4.241	61.903	0.000
Concern about human interaction with floods	3.170	4.107	68.955	0.000
Expected flood damage	3.707	4.155	25.185	0.000
Value of the property (house)	3.319	3.340	8.658	0.070
Value of the property (crops)	3.744	4.073	38.743	0.000
Fear based on current knowledge	3.303	3.892	34.694	0.000

The average values of the indicators in the fear index of risk perception are shown in the figure below.

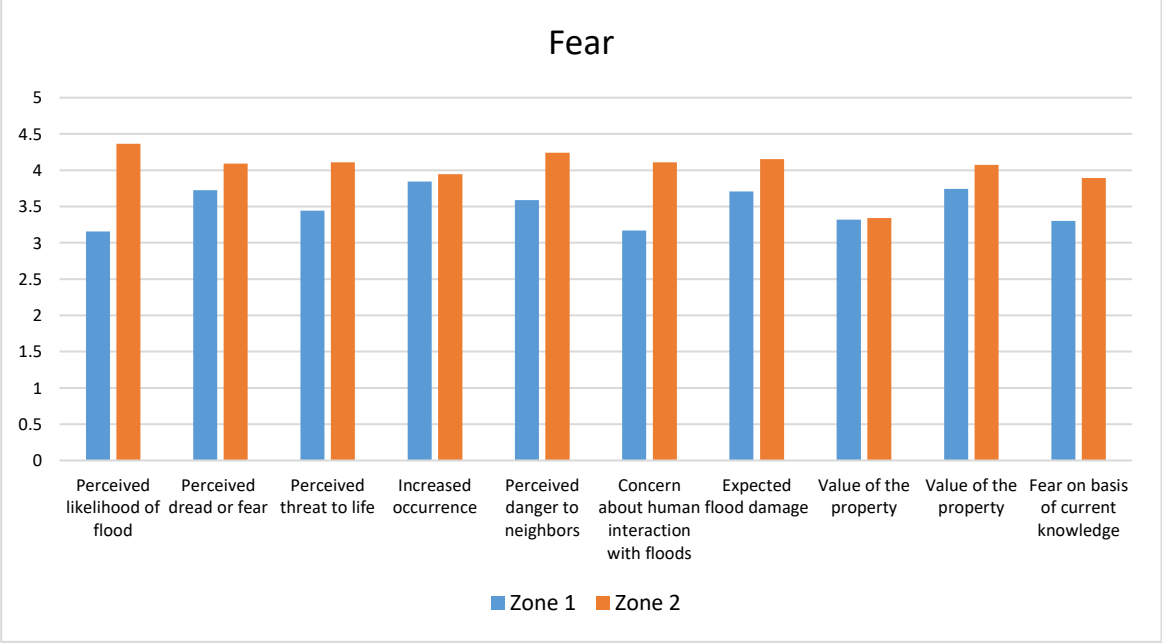

Figure 16 Fear index of risk perception

5.2 Attitude and behavior index

The indicators in attitude and behavior index of risk perception are shown in table 1 above. The average values of all the indicator in attitude and behavior index of risk perception is shown in the table below. the table shows that the average value of the indicator “perceived ability to cope” is ‘3.154’ in zone 1 and ‘3.461’ in zone 2. which shows that more people in zone 2 believe that they have more coping capacity to deal with the floods. the chi-square and significance values of this indicator show that there is no significant difference between the responses of people. The indicator “perceived harmful effects that can be reduced” has an average value of ‘3.409’ in zone 1 and ‘3.715’ in zone 2. which shows that more people living in zone 2 believe that harmful effects of floods can be reduced by taking proper protective measures. the chi-square and significance values of this indicator indicate that there is a significant difference between the responses of people. The indicator “supplies interruption” has an average value of ‘3.260’ in zone 1 and ‘3.344’ in zone 2. which shows that more people living in the zone 2 believe that due to floods the deliveries of supplies can be interrupted. the chi-square and significance values of this indicator show that there is no significant difference between the responses of people. The indicator “changes in relationships” has average value of ‘3.106’ in zone 1 and ‘2.870’ in zone 2. which shows that people living in zone 1 are more afraid that the crisis during floods can change their relationships with their neighbors. the chi-square and significance values show that there is significant difference between the responses of people. The indicator “adapting lifestyles” has an average value of ‘3.377’ in zone 1 and ‘3.478’ in zone 2. which means that people living in zone 2 agree more that they can adapt the changes in their lifestyles due to floods. the chi-

square and significance values indicates that there is no significant difference between the responses of people.

Table 13 Attitude and behavior index of risk perception

Indexes and Indicators	Zone 1 (Avg)	Zone 2 (Avg)	Chi-Square	Significance
Attitude and Behavior				
Perceived ability to cope	3.154	3.461	8.879	0.064
Perceived harmful effects that can be reduced	3.409	3.715	12.177	0.016
Supplies interruption	3.260	3.344	6.649	0.156
Changes in relationships	3.106	2.870	26.899	0.000
Adapting lifestyles	3.377	3.478	9.089	0.059

The average values of the indicators in attitude and behavior index of risk perception are shown in the figure below.

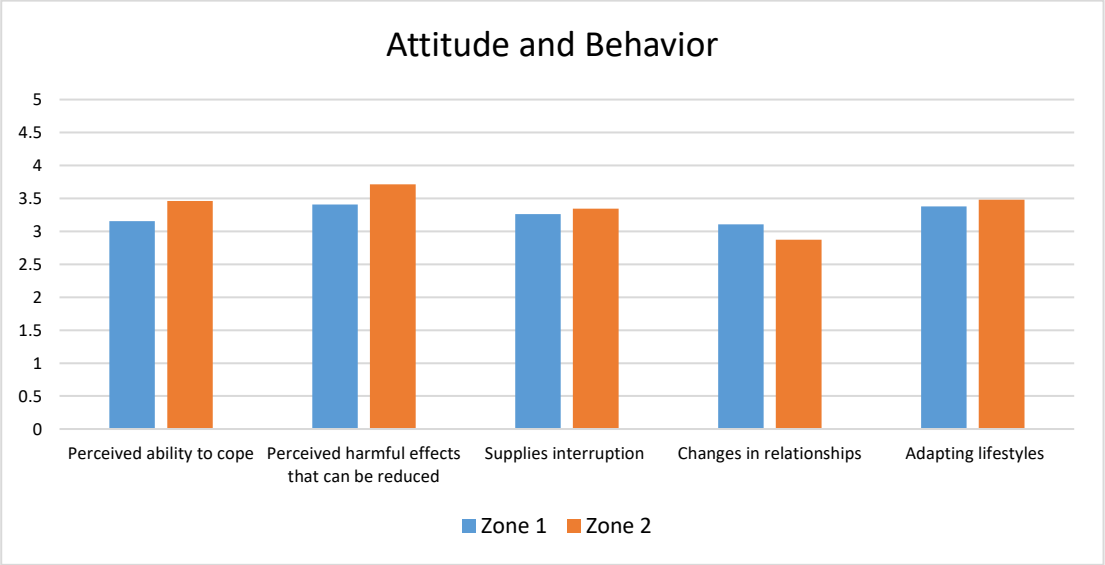

Figure 17 Attitude and behavior index of risk perception

5.3 Awareness and knowledge index

The average values of all the indicator of awareness and knowledge index of risk perception are shown in the table below. The indicator perceived extent of

familiarity is an important part of risk perception studies as it shows how people will act against floods. The responses taken on Likert scale have average values 3.244 and 3.922 in zone 1 and 2, respectively. It indicates people living in zone two are more familiar with floods. The data showed a significant difference between the responses. The indicator "perceived extent of knowledge about rescue and evacuation protocols" has an average value of '3.287' in zone 1 and '3.823' in zone 2. Which means that people living in zone 2 think they have more knowledge about rescue and evacuation protocols. The chi square and significance values of this indicator show that there is a significant difference between the responses of people. The indicator "perceived settlement protection" has an average value of '3.208' in zone 1 and '3.935' in zone 2. Which means that people living in zone 2 think that their settlement is more protected from floods than the people living in zone 1. The chi-square and significance values show that there is a significant difference between the responses of people. The indicator "no dyke protection" has an average value of '3.531' in zone 1 and '3.918' in zone 2. Which means that people living in zone two believe they are safer due to the presence of dyke. The chi-square and significance values of this indicator show that there is a significant difference between the responses of people. The indicator "knowledge about emergency protocols" has an average value of '2.335' in zone 1 and '3.512' in zone 2. Which means that people living in zone 2 think they have more knowledge about the emergency protocols in their area. The chi-square and significance values of this indicator show that there is a significant difference between the responses of people. The indicator "perceived awareness of climate change" has an average value of '3.047' in zone 1 and '3.568' in zone 2. Which means that people living in zone 2 believe that they have more awareness about climate change. The chi-square and significance values of this

indicator show that there is a significant difference between the responses of people. The indicator “perceived understanding of flood causes” has an average value of ‘3.117’ in zone 1 and ‘3.862’ in zone 2. Which means that people living in zone 2 have more understanding of the flood causes than the people living in zone 1. The chi-square and significance values of this indicator show that there is a significant difference between the responses of people.

Table 14 Awareness and knowledge index of risk perception

Indexes and Indicators	Zone 1 (Avg)	Zone 2 (Avg)	Chi-Square	Significance
Awareness and Knowledge				
Perceived extent of familiarity	3.244	3.922	52.435	0.000
Perceived extent of knowledge about rescue and evacuation protocols	3.287	3.823	29.46	0.000
Perceived settlement protection	3.208	3.935	58.178	0.000
No dyke protection	3.531	3.918	19.337	0.001
Knowledge about emergency protocols	2.335	3.512	106.616	0.000
Perceived awareness of climate change	3.047	3.568	47.72	0.000
Perceived understanding of flood cause	3.117	3.862	65.206	0.000

The average values of all the indicators in the awareness and knowledge index of risk perception are shown in the figure below.

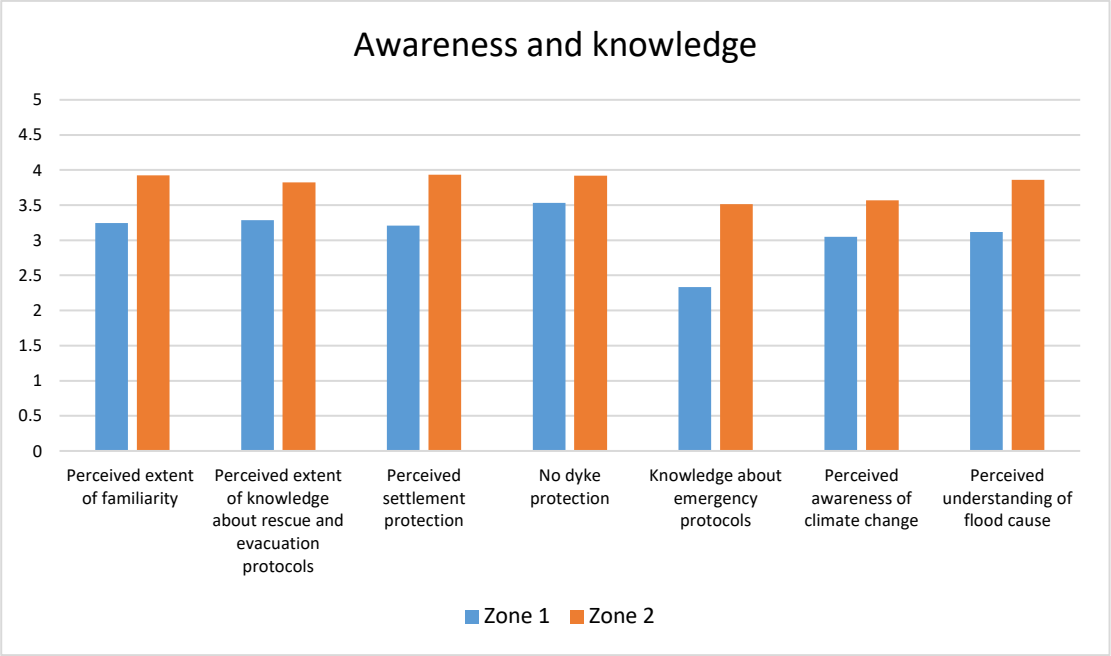

Figure 18 Awareness and knowledge index of risk perception

5.4 Trust index

The trust in information received from any source is an important indicator, because it determines how serious people will take the information. The responses taken on Likert scale have averages 3.606 and 3.711 in zone 1 and 2, respectively. Although there is not much difference but people living in zone 2 believe such information is more reliable. The study found that there is a significant difference between the responses of people. The trust in disaster management agencies is vital as it ensures timely action based on their information. Therefore, the indicator for trust in disaster management agencies was measured on a 1-5 Likert scale. The study found there was a significant difference between Zones 1 and 2. However, the average values were relatively close with each other, i.e., 3.053 and 3.099, in zone 1 and 2, respectively. The trust in policies of the disaster management agencies is also very essential, because it informs people about the level of preparedness they need

to tackle the floods. So the indicator of trust in the policies was measured on Likert scale. The study found that there was a significant difference between the responses. However, the average values were relatively close to each other, i.e., 2.930 and 3.056, in zone 1 and 2, respectively. Trust in emergency plan of the government is very essential in because it paints clear picture of the expectations of the people and how to act accordingly. The responses were taken on Likert scale. The average values were 3.287 and 3.331 in zone 1 and 2, respectively. The study found there was no significant difference. Trusting the policies of your government is an important indicator because it shows the level of commitment of government to its citizens. The responses taken on Likert scale show the average values were 3.074 and 3.275 in zone 1 and 2, respectively. The results show that people living in zone 2 trust government policies more. The study found that there is no significant difference in the responses.

Table 15 Trust index of risk perception

Indexes and Indicators	**Zone 1 (Avg)**	**Zone 2 (Avg)**	**Chi-Square**	**Sig.**
Trust and Confidence				
Trust in information received from different sources	3.606	3.711	34.29	0.000
Trust in disaster management agencies	3.053	3.099	22.164	0.000
Trust in disaster management policies	2.930	3.056	15.945	0.003
Trust in the emergency plan of the government	3.287	3.331	5.057	0.281
Trust in Government policies	3.074	3.275	5.917	0.205

The average values of the indicators in reliability index of risk perception are shown in the figure below.

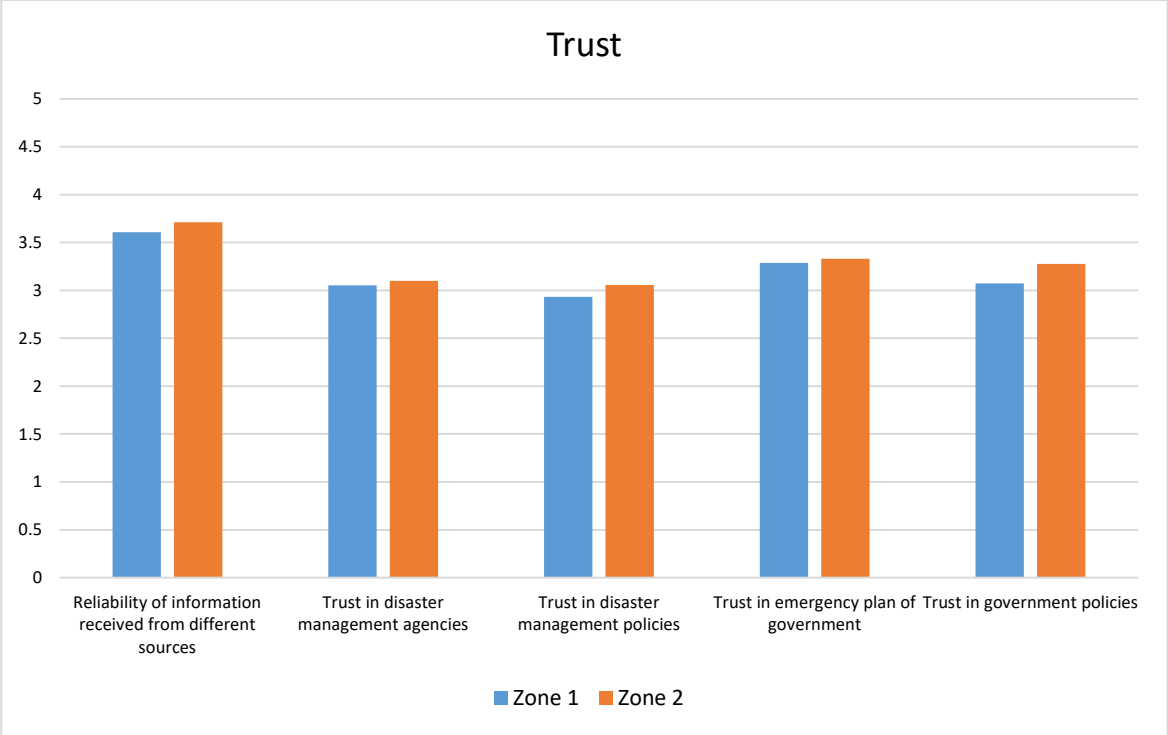

Figure 19 Trust index of risk perception

5.5 Determinants of risk perception

The linear regression analysis was applied to the average risk perception and the socio-economic variables to investigate the determinants of risk perception. The model was checked whether it was a good fit or not. The Anova value came out to be 0.000 with an f value 19.296. It shows that the variables chosen to explain the risk perception are good enough. Therefore, our model is acceptable for determining the determinants of risk perception.

Table 16 Anova test

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	28.040	9	3.116	19.296	.000[b]
Residual	66.200	410	.161		
Total	94.240	419			

The coefficient table of the regression analysis shows that no significant change in risk perception is seen by investigating the variable gender of the respondent (sig=0.247). The variable house ownership status of the respondent does not have any significant effect on the risk perception of the people (sig=0.182). There is a significant change in risk perception while investigating the past flood experience of the respondents (sig=0.000). The significance value of the variable household size of the respondent shows that it has a significant effect on the people's risk perception (sig=0.000). The variable monthly income of the respondent has a significant effect on the people's risk perception (sig=0.007). The respondent's variable employment status does not significantly affect the risk perception of the people (sig= 0.139). No significant change in the risk perception of the people is seen while investigating the variable number of employed people at home (sig=0.928). The people's risk perception changes significantly by investigating the variable qualification of the respondent (sig=0.001). The age of the respondent has no significant effect on the risk perception of the people (sig=0.782).

Table 17 Linear regression for checking the determinants of risk perception

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.713	.163		22.833	.000
Gender of the respondent	-.055	.048	-.058	-1.159	.247
house ownership status of the respondent	-.081	.060	-.059	-1.336	.182
past flood experience of the respondent	-.324	.074	-.201	-4.387	.000
household size of the respondent	.043	.007	.300	6.065	.000
Monthly income of the respondent	1.003	.000	.120	2.697	.007
Employment status of the respondent	.075	.051	.076	1.481	.139
how many people are employed at respondent's house	.002	.020	.004	.091	.928
Qualification of the respondent	-.078	.024	-.153	-3.206	.001
Age of the respondent	.001	.002	.012	.276	.782

The socio-economic variable like gender, house ownership status, employment status, number of employed people at home, and age of the respondents does not significantly affect the people's risk perception, so we can say that these are not the determinants of risk perception. In contrast, the socio-economic variables past flood experience, household size, monthly income, and qualification change the people's risk perception significantly, so we can say that these are the determinants of risk perception.

CHAPTER 6

Risk communication and its determinants

6.1 Modes of risk communication

The mode of risk communication is a very important thing to understand in risk communication, especially in rural communities where people have less access to necessities. It is an important part of risk communication, and through them, the communities get warnings and information regarding the riverine floods. Radios were frequently used as source of entertainment and news before the invention of televisions, now a day's radios are not much common, but some old people living in rural areas still use radios. In zone 1, 54.78% of the respondents assured they heard announcements on the radio at the time of the flood. In contrast, 54.74% of respondents got warning announcements through radio in zone 2.

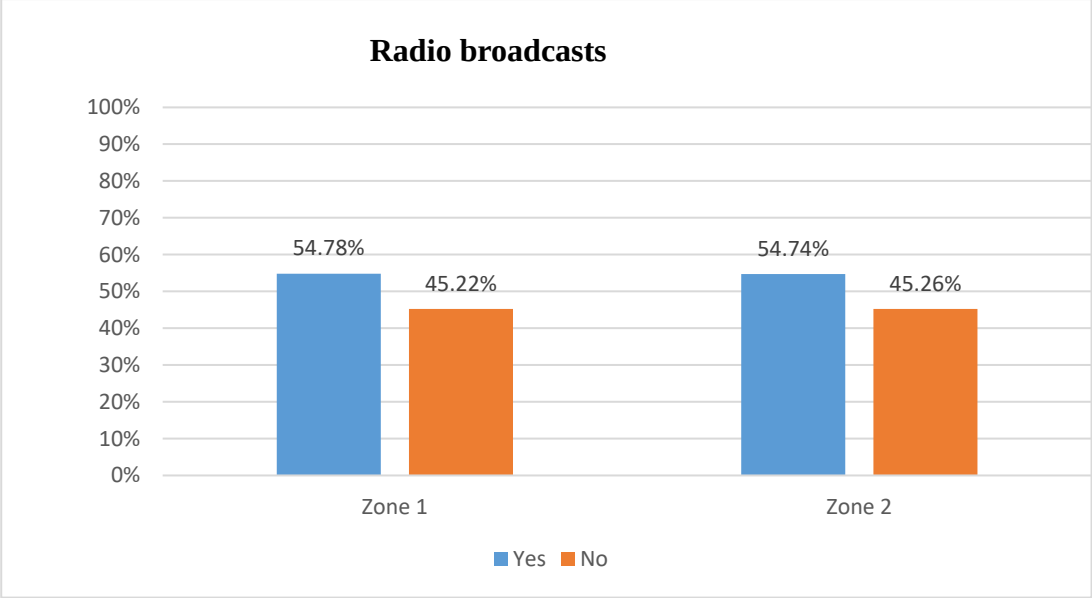

Figure 20 Radio broadcasts

As per my knowledge, television is the most important tool for sharing knowledge spreading awareness and entertainment. Now a day's majority of people have access to televisions. If not at their home, then somewhere else like in hotels tea stalls. It has become a kind of tradition in rural areas that people sit in small hotels and tea stalls and watch television for entertainment. Our data revealed that around 97.87% and 92.67% of respondents saw television broadcasts before the flood in ZONE 1 and ZONE 2, respectively.

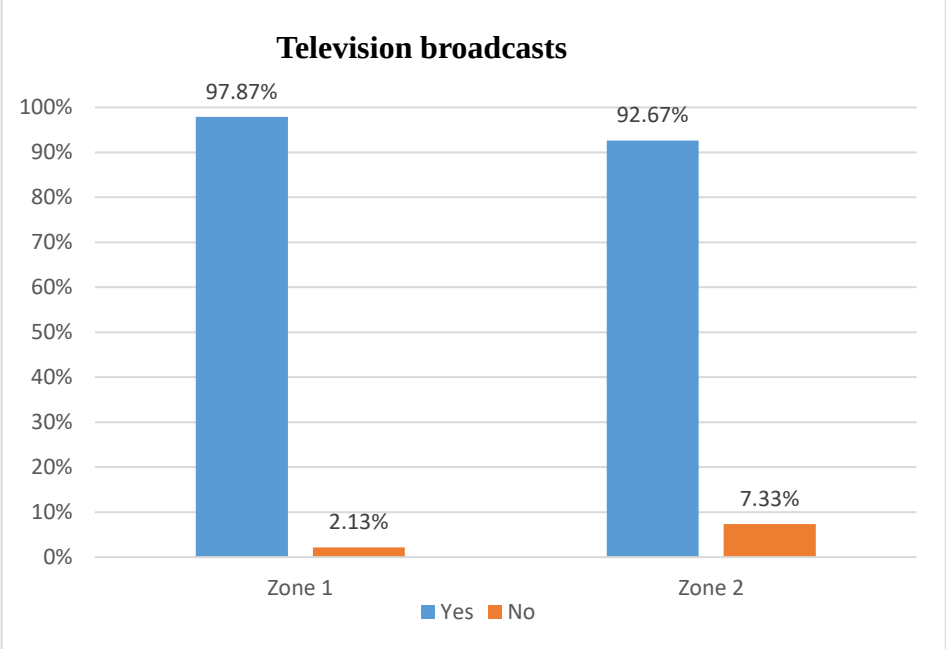

Figure 21 Television Broadcasts

In this modern era, mobile phones have become a necessity. It keeps you connected with everyone in your contact, even in rural areas, majority of people have access to mobile phones, about 82.44% and 55.6% of the sampled population got warning text messages from Provincial Disaster Management Authority at the time of floods in zone 1 and zone 2, respectively.

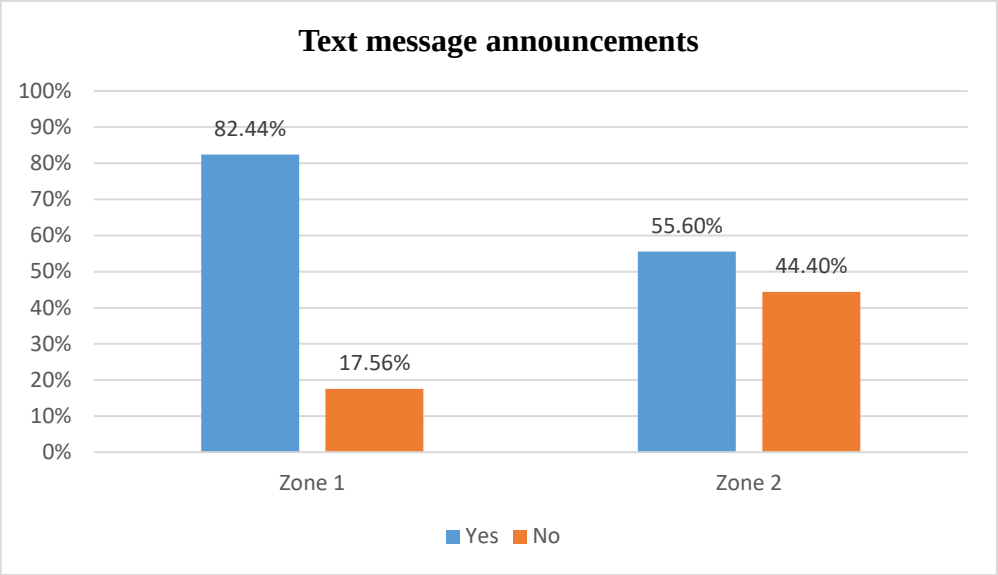

Figure 22 Text message announcements

Announcements through mobile speakers have become a conventional way of communicating with the public. In ZONE 1, 90.42% of people of the sampled population get warning announcements through mobile speakers. In comparison, 92.24% of people get the warning announcements through mobile speakers in ZONE 2. In rural settlements, announcements are being carried out by speakers in mosques, speakers mounted on any vehicles, etc.

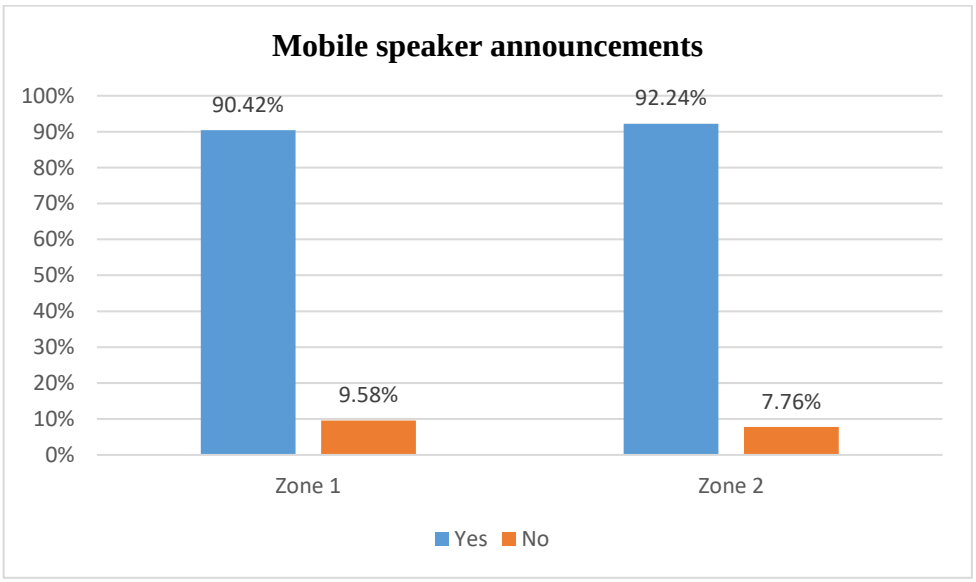

Figure 23 Mobile speaker announcements

This data indicates that television and mobile speaker announcements are more effective modes of risk communication in this area, as shown in figure 3 below. One of the reasons for the other modes being less effective is that the people living in this area have less access to radio and mobile phones than television and mobile speakers. One observation during the field survey was that the mobile speaker announcements are mostly carried out by the people living in the locality, not by the government at the time of floods.

6.2 Risk communication

6.2.1 Ease to understand

The table below shows the average values of all the indicators for ease of understanding the risk communication index. Ease in understanding information is an essential component of risk communication studies, because it gives the level of understanding people will get about the floods. It is very important in risk communication to make people understand the information being conveyed. In this section the ease to understand the information through different risk communication mediums are accessed. All the responses were taken on Likert scale and their averages are calculated with respect to zone 1 and 2. The indicator radio announcement has average values 2.425 and 3.594 in zone 1 and 2, respectively. It shows people living in zone 2 have more ease in understanding the information being conveyed through radio announcements. The study found significant difference between the responses. Televisions are being used frequently and are an essential component of news sharing and entertainment. The ease to understand index of television broadcasts has average values 3.351 and 3.961 in zone 1 and 2,

respectively. It shows people living in zone 2 have more ease in understanding television broadcasts. The data found significant difference between the responses of people. Mobile phones are being used by everyone now a day's. Warning announcement through text messages have become an important component of risk communication practices. The text messages having the announcement have to be easy to understand by public. The responses taken for this indicator have average values 3.079 and 4.030 in zone 1 and 2, respectively. People in zone 2 have more ease in understanding the text messages carrying warning announcements about the floods. The study found significant difference between the responses of people. It is a routine in rural areas to give announcements on speakers in mosques and speakers installed on vehicles. So that everyone in the area listens to the announcements. It is also an important part of risk communication. Ease in understanding the announcements on mobile speakers has an average value of 3.750 and 4.034 in zone 1 and 2. Which means that the people living in zone 2 have more ease to understanding the announcements on mobile speakers. The study found significant difference between the responses. The indicator eases to understand the announcements on pamphlets has an average values of 3.180 and 4.034 in zone 1 and 2. Which means that the people living in zone 2 have more ease to understanding the information given through pamphlets. The data shows a significant difference between the responses.

Table 18 Ease to understand the index of risk communication

Indexes and Indicators	Area 1 (Avg)	Area 2 (Avg)	Chi-Square	Sig
Ease to understand				
Radio Announcements	2.425	3.594	130.596	0.000
Television Broadcasts	3.351	3.961	63.42	0.000
Text Messages	3.079	4.030	101.763	0.000
Mobile Speakers Announcements	3.750	4.034	34.724	0.000
Pamphlets	3.180	3.534	46.301	0.000

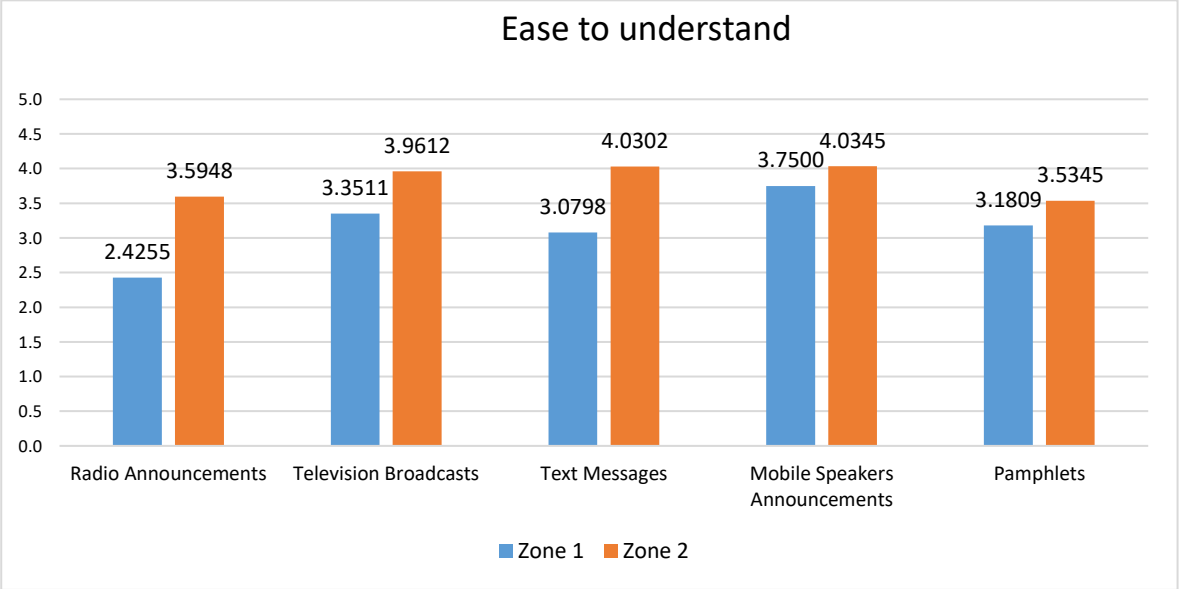

Figure 24 Ease to understand the index of risk communication

6.2.2 Accuracy

The average values of all the indicators in the accuracy index of risk communication are shown in the table below. Accuracy of such information in an essential component of risk communication studies. As it helps in giving the actual picture of the threat and earns the trust of the public. In order to make people believe them the accuracy of such information through all the risk communication mediums should be very high. The indictor accuracy of radio announcements has an average

value of 3.436 and 3.637 in zone 1 and 2, respectively. which means that the people living in zone 2 believe more that the announcements through radio broadcasts are accurate. The study found significant difference between the responses. The indicator accuracy of television broadcasts has an average value of 3.367 and 3.982 in zone 1 and 2. Which means that the people living in zone 2 think the announcements through television broadcasts are accurate. The study found a significant difference between the responses. The accuracy of information through text messages has an average value of 3.383 and 3.642 in zone 1 and 2, respectively. Which means that the people living in zone 2 believe the accuracy of text message announcements is more. the study found significant difference between the responses. Accuracy of information received through mobile speakers has an average value of 2.542 and 3.849 in zone 1 and 2, respectively. Which means that the people living in zone 2 believe the accuracy of announcements through mobile speakers is higher. The data shows significant difference between the responses. The accuracy of information received through pamphlets has an average value of 3.319 and 3.551 in zone 1 and 2, respectively. Which means that people living in zone 2 believe the information received by pamphlets are more accurate. The study found significant difference between the responses of people.

Table 19 Accuracy index of risk communication

Indexes and Indicators	Zone 1 (Avg)	Zone 2 (Avg)	Chi-Square	Sig
Accuracy				
Accuracy of Radio Broadcasts	3.436	3.637	29.709	0.000
Accuracy of TV Broadcasts	3.367	3.982	38.999	0.000
Accuracy of Text Messages	3.383	3.642	43.139	0.000
Accuracy of Mobile Speakers	2.542	3.849	66.223	0.000
Accuracy of Pamphlets	3.319	3.551	33.933	0.000

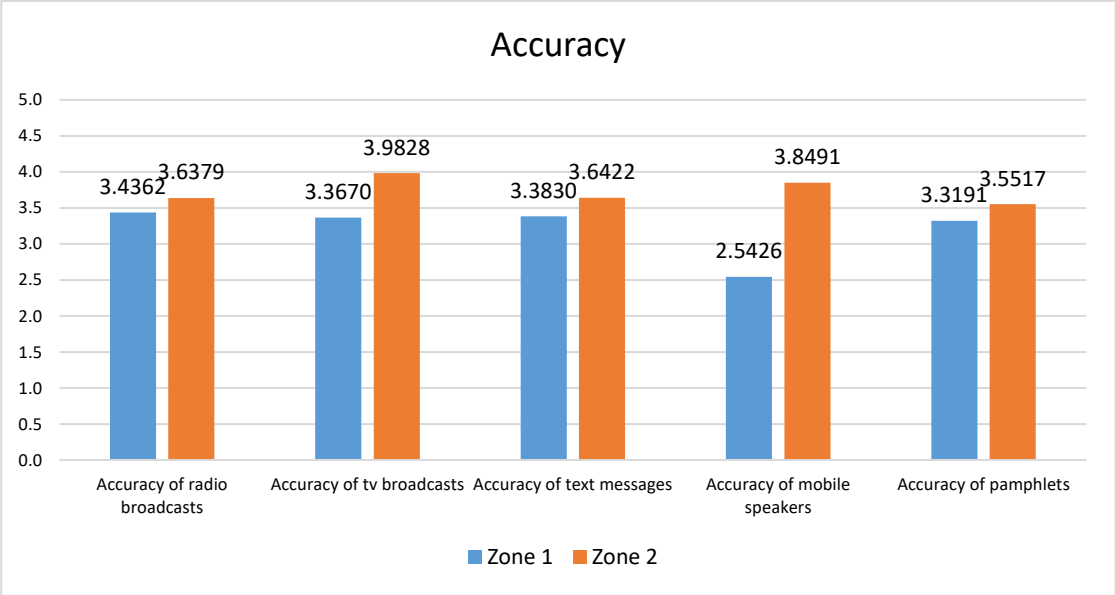

Figure 25 Accuracy index of risk communication

6.2.3 Reliability

The average values of all the indicators in trust on messenger index of risk communication are shown in the table below. Reliability of message conveyor is an essential component of risk communication practices. People will only believe the message if the source is trustworthy. The reliability is further divided into four categories as shown above in table 2. Reliability of radio and television has an average value of 3.383 and 3.849 in zone 1 and 2, respectively. Which means that the people living in zone 2 believe radio and television are trustworthy source of information than the people living in zone 1. The data found significant difference between the responses of people. Reliability of NDMA, PDMA and local government has an average value of 3.420 and 3.866 in zone 1 and 2, respectively. It shows that people living in zone 2 think that PDMA, NDMA and their local government office are reliable source of announcements. The data found significant difference between the responses of people. Reliability of community members and local representatives has an average value of 3.393 and 3.590 in zone 1 and 2. Which

means that people living in zone 2 trust their community members and representatives more than the people living in zone 1. The study found no significant difference between the responses of people living zone 1 and 2, respectively. Reliability of rescue, police and army has an average value of 3.404 and 4.150 in zone 1 and 2. Which means that the people living in zone 2 think rescue, police, and army are reliable more than the people living in zone 1. The data found significant difference between the responses.

Table 20 Reliability index of risk communication

Indexes and Indicators	Zone 1 (Avg)	Zone 2 (Avg)	Chi-Square	Significance
Reliability				
Reliability of Radio, TV	3.383	3.849	33.942	0.000
Reliability of NDMA, PDMA and Local Government	3.420	3.866	29.031	0.000
Reliability of Community Members and Local Representatives	3.393	3.590	5.913	0.315
Reliability of Rescue, Police, Army	3.404	4.150	42.864	0.000

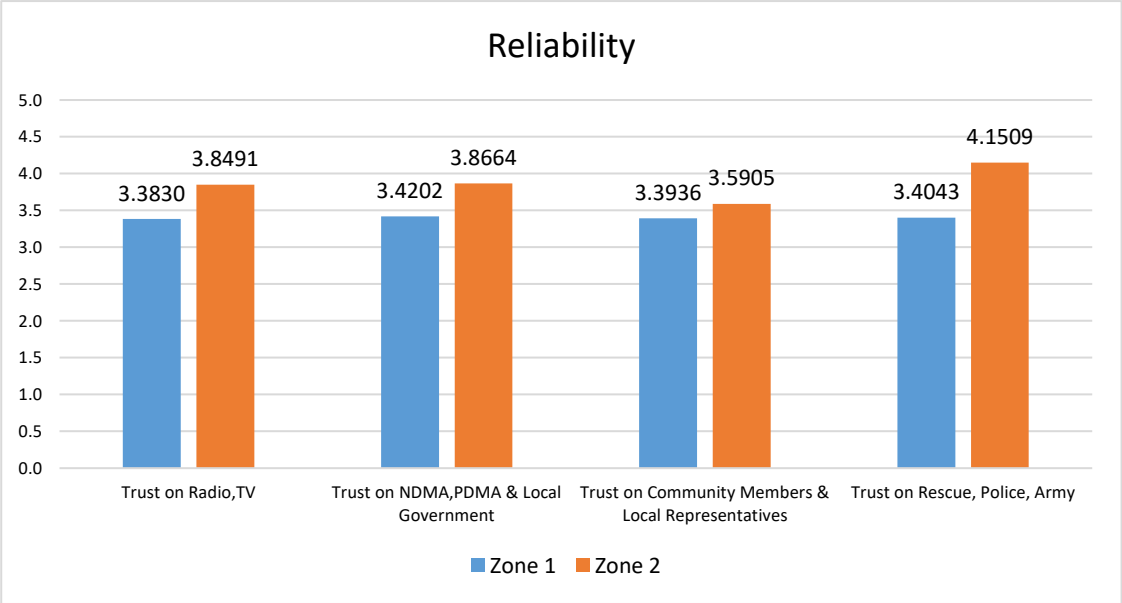

Figure 26 Reliability index of risk communication

6.3 Determinants of risk communication

The linear regression analysis was applied to the average risk communication and the socio-economic variables to investigate the determinants of risk communication. The model was checked whether it was a good fit or not. The Anova value came out to be 0.000 with an F value 22.379. It shows that the variables chosen to explain the risk perception are good enough. Therefore, our model is acceptable for determining the determinants of risk communication.

Table 21 ANOVA test

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	52.259	9	5.807	22.379	.000[b]
Residual	106.379	410	.259		
Total	158.638	419			

The coefficient table of the regression analysis shows that no significant change in risk communication is seen by investigating the variable gender of the respondent (sig=0.717). The variable house ownership status of the respondent has a significant effect on the risk communication of the people (sig=0.001). There is a significant change in risk communication while investigating the past flood experience of the respondents (sig=0.000). The significance value of the variable household size of the respondent shows that it has a significant effect on the risk communication of the people (sig=0.000). The variable monthly income of the respondent has a significant effect on the risk communication of the people (sig=0.000). The variable employment status of the respondent affects the risk communication of the people significantly (sig= 0.000). No significant change in the

risk communication of the people was seen while investigating the variable number of employed people at home (sig=0.945). The risk communication of the people changes significantly by investigating the variable qualification of the respondent (sig=0.009). The age of the respondent has no significant effect on the risk communication of the people (sig=0.617).

Table 22 Linear regression test for checking the determinants of risk communication

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.666	.206		17.787	.000
Gender of the respondents	-.022	.060	-.018	-.363	.717
House ownership status of the respondents	-.245	.077	-.139	-3.201	.001
Past flood experience of the respondents	-.367	.094	-.175	-3.916	.000
Household size of the respondents	.052	.009	.276	5.722	.000
Monthly income of the respondents	1.703	.000	.157	3.612	.000
Employment status of the respondents	.234	.064	.182	3.639	.000
How many people are employed at respondent's house	-.002	.026	-.003	-.069	.945
Qualification of the respondents	-.081	.031	-.122	-2.627	.009
Age of the respondents	.001	.002	.021	.500	.617

The socio-economic variables, gender of the respondents, number of people employed at respondent's house, and age of the respondents do not affect the risk communication, so these are not the determinants of risk communication. In contrast,

the socio-economic variables house ownership status of the respondents, past flood experience, household size, monthly income, employment status, and qualification of the respondents all affect the risk communication significantly, so we can say that these are the determinants of risk communication.

6.4 Risk perception and risk communication linkages

Pearson's correlation test investigated the relationship between risk perception and risk communication. A correlation matrix was developed comparing the risk perception and communication indexes, as shown in the Table below. The correlation table shows that the fear index of risk perception had a strong positive correlation with ease to understand (r=0.638) and accuracy (r=0.557). The awareness and knowledge index of risk perception had a strong positive correlation with ease (r=0.655), accuracy (r=0.560), and trust (r=0.558) at a significance level of 1%. The ease in understanding index of risk communication had a strong positive correlation with accuracy (r=0.713) and trust (r=0.518). This means that if a person perceived more fear, had more awareness and knowledge, and understood announcements easily, their ease in understanding, accuracy, and trust in the messenger improves significantly.

Similarly, there was a weak positive correlation of fear index of risk perception with attitude and behavior (r=0.243), awareness and knowledge (r=0.481), reliability (r=0.162), and trust (r=0.323) at a significance level of 1%. Attitude and behavior index of risk perception had a weak positive correlation with awareness and knowledge (r=0.168), reliability (r=0.135), ease (r=0.210), accuracy (r=0.154) at a significance level of 1%. On the other hand, the awareness index had a weak positive

correlation with reliability (r=0.342). The reliability index had a weak positive correlation with ease (r=0.288), accuracy (r=0.303), and trust (r=0.298) at a p-value of 0.01. The accuracy index of risk communication had a weak positive correlation with trust (r=0.440, p-value=0.01). This means that awareness and trust of risk perception and trust improve with increased fear attitude. If the attitude and behavior of people are improved, they will have more awareness and knowledge, will have more confidence in government, will have the ease to understand announcements, and will think the announcements are more accurate. The attitude and behavior index on risk perception does not correlate with trust (r=-0.06), which shows that we cannot change one by improving the other.

Table 23 Correlation matrix

		Risk perception				**Risk communication**		
		Fear	Attitude	Awareness	Trust	Ease	Accuracy	Reliability
Risk perception	Fear	1						
	Attitude	.243**	1					
	Awareness	.481**	.168**	1				
	Trust	.162**	.135**	.342**	1			
Risk communication	Ease	.638**	.210**	.655**	.288**	1		
	Accuracy	.557**	.154**	.560**	.303**	.713**	1	
	Reliability	.323**	-0.06	.558**	.298**	.518**	.440**	1

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

CHAPTER 7

Institutional challenges

7.1 Irrigation Department

Irrigation Department is one of the most important departments of Pakistan, which deals with storage and construction of reservoirs, supply of irrigation water, sustainable management of water resources, effective flood planning and management. The irrigation department has a very crucial role when dealing with floods. They must monitor and repair all the embankments and infrastructure to keep the communities safe from floods.

During the interview of irrigation officials, when they were asked about the likelihood and magnitude of floods, they told us that every year 3-4 months (June to September) is flood season, and medium to high flood level of water flows in the Indus River. When they were asked about the reason for damages of floods. They said that due to the development of infrastructure on natural water channels, the natural flow of water gets interrupted. After construction of bridges the natural water channel is narrowed down in width due to the supporting infrastructure of bridges like embankments, dykes, spurs. In such areas water is deep and flows at higher velocities. Which causes small damages with time, which can in long run cause flooding events.

One of the officials was confident that flooding is not possible in a natural habitat without any infrastructure development. When asked about their role during flooding events, he specified that their only role is to monitor water levels, gather

data, and ensure the supplies of irrigation water to the designated areas. If the water level is crucially high, it can overtop any embankment, or if there is a possibility of a breach in an embankment, it is their duty to inform the district administration office for necessary action.

The irrigation officials further told us that the government allows people to grow crops in flood plains because the yield of such crops is very high. It helps in the growth of the economy and gives business to the local people as Pakistan generates most of its income from the agriculture sector. After floods government also pays such people for the damages they endure.

The officials also informed us that there is no regular establishment for check and balance of embankments. They hire daily wagers for monitoring embankments and maintenance works during the flood season. Still, a separate unit comes to inspect the embankments before, during, and after the monsoon season and instruct any required fixation works. When they were asked about any financial issues for fixation works, they ensured they had plenty of funds for fixing embankments. They were quite relieved now that the secretary of the irrigation department had established a separate division for dealing with floods. They were also hopeful that their workload would be decreased now because the floods related works would be given to the newly established division.

When asked about the issues they face overall, they told us they do not face any issues for information dissemination. Still, after the floods, the water table rises in the affected area, navigation gets affected, the land becomes saline, and it is impossible to grow crops in such areas.

They complained that people are very uncooperative with them, they start living very close to the embankments and they create issues for any maintenance or development works. They also told us that building roads on embankments is not safe, and it affects the embankments.

Their role in the aftermath of floods is to rehabilitate and rebuilds the damaged infrastructure, and they suggested that a regular establishment for monitoring and maintaining the embankments is necessary for the future.

7.2 Local government

The local government office has a very important role when dealing with floods. The local government department is directly connected with the people, interacts with them on a daily basis, and has all the data of the residents in their area. From awareness raising campaigns to making sure the safety of everyone during floods is the responsibility of the local government.

During the interview of their officials, we were informed that they face many hurdles during crisis situations. One of the hurdles is that people do not listen to them if they ask them to evacuate early. They delay the evacuation process until it's very late. Instead of following the safe practices to steer clear of the floods, people start gathering near the embankments to see the floods and breaches, and they spread panic among each other during the crisis situation. People spread rumors which affects their responses practices. When asked about their department's capacity to deal with floods, they told us they lack the technical capacity, man force, machinery, and resources for proper disaster risk reduction. But they have carried out campaigns to raise awareness among the people and inform them about the evacuation’s routes.

They suggested a strong need for awareness campaigns focused on educating people on how to act during the crisis and how to evacuate safely and not to live very near to the flood plains in Samna Saadat and its surrounding areas. They informed us that they carry announcements on mobile speakers or in the mosques of the area for early warning. So, there should be an efficient warning announcement delivery system to save time.

7.3 Rescue 1122

Rescue 1122 is a very important emergency responding department when it comes to any issue regarding the safety of people, including floods. They are also providing their distinct services effectively in the Dera Ghazi Khan district. Their main duty during floods is rescuing people, ensuring their safety, and providing any emergency medical assistance. During the survey from their officials, we were informed that the rescue department has carried out some evacuation drills in the study area. Rescue 1122 department has also contributed to campaigns for raising awareness of the people in Samina Saadat. During the interviews with the officials, we were told that although the rescue 1122 department tries its best to help the people, they still do not have enough man force and machinery for providing its services efficiently in the study area along with Dera Ghazi Khan. They also informed us that they face difficulties in making people trust them. People during the floods refused to relocate from their dwellings due to their belongings before floods hit their communities. They must carry out rescue operations on boats because people do not cooperate in evacuation until very late. According to the officials, people create problems in the smooth running of their rescue operations which causes

delays. They suggested that the concerned departments should carry out more awareness campaigns for disciplining the people living in the study area and demanded an increase in their department's machinery and man force.

7.4 Agriculture Department

Agriculture is the backbone of Pakistan's economy. It contributes 19% of the GDP of our country, and along with other agro-based products, it contributes 80% of Pakistan's earnings from exports. Punjab province provides the largest share in the national agriculture production. During the interview of their officials, we learned that the government allows and encourages the production of crops in the flood plains of the rivers. The alluvial soil is very fertile, and yields are very high from such crops. For generating more profits government must allow the cultivation of crops in flood plains. There are times when the crops get wasted due to floods, but this is a chance our government is willing to take for its existence and earnings. The officials revealed that only the production of crops is allowed in such areas, but if there is a possibility of flood, people can evacuate easily in time and safely due to the slow onset of riverine floods, but people build other structures like houses or stores in such areas illegally and the flood damages such infrastructure. After floods, if someone's crops get affected government also pays the affected people.

7.5 Provincial disaster management authority

The provincial disaster management authority (PDMA) runs under the National disaster management authority. It came into being after the national disaster management act of 2010. Their focus is ensuring proper disaster risk reduction

practices for combating natural and manmade disasters towards securing the lives and livelihoods of affected people at the local and provincial levels. PDMA specializes in preparedness, mitigation, and an organized response to all disasters. PDMA provides platforms for all provincial departments to come together and strategize management and response to disasters. PDMA also acts as a coordinating authority between Rescue 1122, Civil defense, District governments, and police for immediate rescue and rehabilitation operations. In case of disasters, PDMA overseas rescues and evacuation of the affected people and provides relief, early recovery, and long-term rehabilitation to the affected people. PDMA also works with the districts departments after disasters to determine the course of action to ensure the long-term rehabilitation for the affected population. During the interview of their officials, we were informed that the provincial disaster management authority is also facing many issues for effective disaster risk reduction practices. The officials told us that they face a shortage of financial resources for dealing with floods as there are substantial damages after every year's flooding season. Apart from the lack of financial resources, they face many issues in the coordination of district departments, as no law gives PDMA any authority over other departments. Every department has its own priorities, limited capacities, and finances. One of the officials told us that since the corona pandemic, their focus is diverted to coronavirus, not floods. Luckily, there has not been any dangerous flooding event during this period. We were informed that PDMA circulates warning announcements through text messages informing people about any upcoming floods and television, but people are still very non-cooperative. The officials suggested that awareness campaigns should be arranged between the people educating them about how to modify their behaviors and to increase the risk perception of people. They also suggested the existence of any

framework which makes coordination between the concerned departments easy and efficient.

Chapter 8

8.1 Conclusion and recommendation

This study was carried out to know the effectiveness of risk communication practices and determine risk perception determinants. The study also aimed to assess the general public's risk perception living near the flood-prone areas in Dera Ghazi Khan. The respondents were divided into two categories: people living nearer to the flood-prone areas and the people living farther from the flood-prone areas. Their responses were compared to better understand the patterns of risk perception among the general public. This study contributes to the existing literature on assessing the risk perception and the effectiveness of risk communication in rural areas of Pakistan. To the best of our knowledge, this study paints a more accurate picture of Pakistan's realities in rural areas.

The effective means of risk communication turned out to be radio broadcasts, television broadcasts, text message announcements, and mobile speaker announcements. Out of these four, Television broadcasts and mobile speaker announcements were the most effective means of risk communication. Most of the people had easy access to the television. Either they had their television in their homes, or they have a certain cultural trend of having gatherings at local hotels and cafes where television is always present. Mobile speakers were found to be the most effective risk communication means other than television. Whenever there is an event of happiness or mourning event, they have this cultural trend of announcing the news on the mobile speakers installed in the Masjids all around the area. People also have more trust in these speaker announcements as these announcements are

made by the local community members. These announcements are done in the local language and are easy to understand as common words are used that are easy to understand by the people.

To communicate risk effectively, we need to understand the target audiences and the challenges they are likely to face in assessing the risk and acting on it. Effective risk communication strategies should be customized to meet the specific interests, concerns, and habits of the target audiences. This means that elders would require different types of messaging and different distribution channels, then the children, adults, and especially the women to inform them about the threats posed by the floods. Risk communication can be improved by establishing and maintaining trust with the public, communicating uncertainty, and effective community engagement and participation. However, still, it is an open topic for discussion and research on which medium or risk communication strategy outruns the others. Everyday advancements are being made in the field of risk communication worldwide. Our risk communication agencies must take all of them into account and develop a composite risk communication model and its implementation strategies for better disaster risk reduction.

The risk reduction focuses mainly on decreasing the consequences of floods through taking protective measures in flood-prone areas. In this study, the results indicated that the people living in the farther area tend to perceive more risk than those living in the closer area. The people living in the farther area have better information, knowledge, and understanding about the occurrence of floods the life and property damages caused by the floods. They may lose their houses, agricultural lands, and crops to these floods. They also know that floods and other natural

disasters can result from human activities, and the frequency of floods will increase in the future. People living in farther areas also believe in mitigation and preparedness measures. They believe that they can cope with food shortages and poor service delivery during the floods and can survive through difficult times. During the survey, one of the reasons for the better risk perception of people living in farther areas is that they have more past flood experiences than the people living in closer areas. Most people living in the farther area moved from, the closer area due to the recurrent floods, particularly after the super flood of 2010. That is why they take the threat more seriously and have better risk perceptions than their peers.

While people living in nearer areas have many flood-related issues, they have their own paradoxes of insecurities, excuses, and financial issues that compel them to live in flood-prone areas. They do not trust their institutions and disaster management agencies and resultantly do not trust their policies, awareness campaigns, and emergency plans. They do not take the information about floods provided by the government and other sources seriously and say that Allah will protect them from these disasters. These disasters are the result of the anger of Allah.

All around the world, it is discussed in various studies that the people who live near an embankment seem to develop a false sense of security that the embankment will save them from floods. This sense of security gets strengthened by the passing time without any catastrophic flooding event, and they eventually forget the consequences of living in a flood-prone area. People need to be reminded that they are prone to flooding events and what damages a flood can cause. After the flood of 2010, in the following years, floods did come but not of that severity. These yearly

floods became a routine for these people. They are afraid of floods but are not motivated to change their fatalistic behavior.

In Pakistan, state institutions cannot deal with floods effectively. Local, provincial, and national flood institutions also lack coordination among them. The NDMA (National Disaster Management Authority) and FFC (Federal Flood Commission) lag from their stated objectives and responsibilities due to inadequate expertise and technical knowledge required for effective flood management. NDMA is not playing its role in regulating, coordinating, training the staff, and employing the latest technologies to develop an effective disaster management system. In the provincial irrigation departments, the majority of the irrigation engineers do not have enough capacity to deal with floods effectively. Pakistan's Meteorological Department is lacking in modern technology to forecast flash flooding.

The Disaster management agencies and the Government must take suitable measures to raise awareness and remind people about the terrors of floods from time to time. It is also discussed in a study of (Yamada et al., 2011) that visual reminders can be proved more effective because they leave a deeper impression on people's minds. Some people have personal preferences to be informed about a flood risk (Ping et al., 2016). Basin level flood management plans lead towards effective and sustainable integrated flood management. So far, no comprehensive flood management plan at basin level has been developed in Pakistan. Due to poor support from research experts and research institutions, the country cannot formulate effective flood management strategies. In addition, flood management planning is hardly mainstreamed into national development policy.

The disaster risk reduction plan should include a bottom-up approach rather than a top-bottom. Only the structural measures are not enough to save communities from floods. Our government realizes it. Still, effective non-structural measures must be put into practice, i.e., risk perception and effective risk communication towards increasing disaster resilience. The participatory approach is the most effective approach for getting the nonstructural measures into practice. Through this approach, communities are engaged in all the flood disaster risk reduction activities, including awareness campaigns, disaster preparedness, increasing capacities, effective risk communication. Including the communities in such activities gives a better insight into ground realities like which risk communication medium is effective and what strategies should be formulated for better flood risk reduction. Participatory Disaster Risk Reduction practices can be very effective in developing countries where a lack of financial resources is a major challenge.

The findings of these studies show a significant correlation between the indexes of risk perception and risk communication in rural flood-prone areas. It can be helpful for the agencies working on the local level to organize campaigns and workshops to raise awareness and modify the behavior of the people living in flood-prone rural areas of Pakistan. District disaster management authorities are still nonexistent in the field, and local authorities manage the floods on an ad hoc basis. The findings of this study can be helpful for such authorities and local governments form risk communication strategies for flood risk reduction, especially in the rural areas of Pakistan. The flood risk reduction needs to be more proactive. This study can be very helpful for the National Disaster management agency in informing

policies and frameworks for implications of those policies for better flood disaster risk reduction.

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Annexures

Annexure A

Please fill the following

Gender | Male | Female | Other | Age

_____

Qualification | Under matric | Matric | Graduate | Higher | Household Size_____

Employment Status | Employed | Unemployed | Monthly Income

_____

House ownershi | Owned | Rental | Employed people at home

_____ | Yes | No

Past Flood Experience

Please fill in the following blanks about your household and hazard in your area

1. How much years have you lived in this community?

   _____

2. What is the Age of the building you live in?

   _____

3. Is there any person with chronic illness and disability in your house?

   _____

4. What is the construction material of your house?

   _____

5. Do you have any vehicle in your household?

   _____

6. What is the average frequency of flood in your area?

   _____

7. How much average warning time do you get about a flood?

   _____

8. For how many average days the flood water stays in your area after a flood?

   _____

9. What is the average depth of flood water?

   _____

10. Are you willing to evacuate if a floods comes?

    _____

11. Did you evacuate last time?

    _____

12. How much time do you need to evacuate from your community?

    _____

13. Do you have insurance?

    _____

14. Which of the following do you have at your home?

Mobile	TV	Radio	Internet	Electricity

15. How much average damages do the flood causes?

insignificant	minor	Moderate	major	catastrophic

16. What is the likelihood of flood this year?

Rare	Possible	likely	very likely	Certain

How much do you agree to the following statements? (Risk perception)

No.		Strongly Disagree 1	Disagree 2	Uncertain 3	Agree 4	Strongly Agree 5
17	How much do you think there will be a flood this year?					
18	How much are you afraid of the flood?					
19	How much do you think the flood can take a life?					
20	How much are you afraid there will be increased number of floods in the future?					

21	How much do you think the flood is dangerous to your family and neighbors?					
22	How much do you think that human activities causes floods?					
23	How much damages do you think a flood can cause?					
24	How much afraid do you think you are to lose your house because of floods?					
25	How much afraid do you think you are to lose your crops because of floods?					
26	How much afraid are you of flood based on your current knowledge and understanding?					
27	How much do you think you are able to deal with the floods?					
28	How much do you think the effects of floods can be reduced?					
29	How much do you think the flood can interrupt supplies deliveries?					
30	How much do you think the flood can change your relationship with your neighbors?					
31	How much change in your lifestyle do you think you can adapt because of the floods?					
32	How much do you think you are familiar with the floods?					
33	How much do you think you know about the rescue and evacuation procedures of floods in your area?					
34	How much do you think your settlement is protected from the floods?					
35	How much do you think the dyke/embankment will protect you from floods?					
36	How much do you think you are aware of the emergency protocols of floods?					
37	How much do you think you are aware of climate change?					
38	How much do you understand the causes of floods?					
39	How much reliable is the information about floods which you obtain from different sources? (TV, radio, text messages, mobile speakers, local govt.)					
40	How much do you trust the disaster management agencies dealing with floods in your area?					
41	How much do you trust the disaster management policies dealing with floods in your area?					
42	How much do you trust in emergency plan of government in dealing with floods?					
43	How much do you trust in government policies regarding floods?					

How much do you agree with the following statements? (Risk communication)

No.		Strongly Disagree 1	Disagree 2	Uncertain 3	Agree 4	Strongly Agree 5
44	How much do you think the announcements on radio were easy to understand by you?					
45	How much do you think the announcements on television (news channels) were easy to understand by you?					
46	How much do you think the announcements on text messages were easy to understand by you?					
47	How much do you think the announcements on mobile speakers were easy to understand by you?					
48	How much do you think the announcements through pamphlets were easy to understand by you?					
49	How much do you think the announcements on radio before the floods are accurate?					
50	How much do you think the warning announcements on radio during the floods are accurate?					
51	How much do you think the mitigation measures announcements on radio after the floods are accurate?					
52	How much do you think the announcements on television (news channels) before the floods are accurate?					
53	How much do you think the warning announcements on television (news channels) during the floods are accurate?					
54	How much do you think the announcements on television (news channels) after the floods are accurate?					
55	How much do you think the announcements through text messages before the floods are accurate?					
56	How much do you think the warning announcements through text messages during the floods are accurate?					
57	How much do you think the announcements through text messages after the floods are accurate?					
58	How much do you think the announcements through mobile speakers before the floods are accurate?					
59	How much do you think the warning announcements through mobile speakers during the floods are accurate?					

60	How much do you think the announcements through mobile speakers after the floods are accurate?					
61	How much do you think the announcements through pamphlets before the floods are accurate?					
62	How much do you think the announcements through pamphlets after the floods are accurate?					
63	How much do you think you trust radio, television (news channels)?					
64	How much do you think you trust (NDMA, PDMA, Local Government)?					
65	How much do you think you trust (community members, local representatives)?					
66	How much do you think you trust (rescue, police, army)?					
67	How much do you think the Government interacts with your representatives regarding flood preparedness?					
68	How much do you think the government helps you to prepare your crops against floods?					
69	How much do you think you were informed about the evacuation routes?					
70	How much do you think you were informed about any emergency helpline number?					
71	How much do you think you were informed about Government shelters accommodating the people during the floods					
72	How much do you think the Government contacts and help the people who lost their homes during floods?					
73	How much do you think there is any website or online tool giving information regarding recovery from floods?					
74	How much do you think the Government takes feedback from you to improve risk communication?					
75	How much do you think the government tries to improve the risk communication in your area?					
76	How much do you think the Government tries to reduce the psychological distress in people?					
77	How much do you think the government announces any secondary illness caused by floods?					
78	How much do you think your knowledge is increased by the information provided by the Government?					
79	How much do you think the Government has improved your self-efficacy?					

80	How much do you think the technical risk communication in your area is effective?					
81	How much do you think the Government encourages the public participation?					
82	How much do you think community meetings/ workshops in your area are arranged by the Government?					

Please fill the following

No.		**Yes**	**No**
83	Radio broadcasts		
84	Television broadcasts		
85	Text messages		
86	Announcements on mobile speakers		

87. Please give any suggestions to improve disaster management practices in your area.