IFRC Global Disaster Preparedness Center

RESEARCH PAPER

Unlocking Climate Resilience:

Assessing the Socio-Economic Benefits of Resilience Incentives for Informal Sector Households in Disaster-Prone Indian Cities

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Abstract

Nowadays, natural hazards like floods, disasters, and earthquakes severely affect the inhabitants residing in urban disaster-prone areas. If we are investigating a special target group that is considered an essential contributor to our society, then our understanding of the severity of the disaster will become more comprehensive. An excellent example of such a target group is informal sector households living in the disaster-prone areas. The ravage of the disaster will destroy their socio-economic and environmental imbalance. Based on this, the study is designed to investigate the socio-economic benefits and aspects of resilience incentives in the urban informal sector. The study is conducted in Idukki district in Kerala, one of the highest disaster-prone areas in South India. The study has used an exploratory research design including qualitative and quantitative data. The data were collected from disaster-affected informal households based on the random sampling technique. To administer the data, in-depth face-to-face interviews were conducted. Finally, the study found that the respondents were still suffering from the disaster aftermath, and there is a wide gap between their losses and the incentives given by the authority.

Keywords: Natural Hazards, Informal Sector, Idukki, Climate resilience incentives, Flood and Landslide, Climate risks, Economic Loss

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1. Introduction

The progression of urbanization leads to the development of slums across developing countries. As urbanization increases, marginal land will be consumed by people for living. This area is situated on steep hillsides, flood plains, and natural hazard zones. It will make them vulnerable to natural hazards (World Bank 2012). The leading problem of urbanization of towns, cities, and mega urban regions is denoted as the problem of accommodation of the growing number of residents who do not have proper housing and land facilities (Paul Jones, 2017). In this context, one of the largest groups of informal sector workers resides in disaster-prone cities. More clearly, in India, especially in the disaster-prone areas, they are becoming the pivot of commercial activities. Alongside this growth, these regions are vulnerable to natural disasters, including floods and other severe weather events. The informal sector in India is the backbone of India's economy. This provides daily bread for millions of families. The rapid growth of urbanization in India failed to provide proper living conditions for this group of people. It forced them to live in informal settlements situated in disaster-prone areas.

Over the last ten years, the risks associated with natural hazards have increased by 40% in cities, and those risks were mainly associated with poverty, lack of basic needs, formation of slum areas, pollution, and environmental degradation (NIDM, UNICEF, 2019). The residents in the disaster-prone areas need assistance in order to tackle the disaster risks. An important tool for this is the provision of resilient incentives to people in need who suffer from disaster vulnerability in urban disaster-prone areas. In the context of urban areas, resilience is the integration of socio-economic, environmental, infrastructural, and institutional resilience (Md. Humayun Kabir et al, 2017). The resilient incentives are denoted as a policy or a mechanism that enables the development of resilient infrastructure by aligning mitigation strategies and offering financial aid and other offerings for resilience-building efforts (National Institute of Building Sciences, 2020). These incentives are helping disaster-affected people in building or adapting communities and infrastructure to recover from disaster and long-term problems of disaster risks and vulnerability (National Institute of Building Sciences, 2020). According to the National Academies Press, the primary benefit of disaster resilience is to anticipate disasters and plan to reduce disaster losses. The government or the concerned authorities should provide incentives to those affected by disaster risks.

This research primarily examines the relationship between informal sector workers residing in urban cities and climate-related disasters in the southern part of India. Based on this, the study explored the central role of resilient incentives in the reduction of economic and environmental costs of natural hazards, particularly among the people of the informal

sector residing in the southern part of India. By examining the interplay between climate change, socio-economic and environmental vulnerabilities, and government incentives, the study aimed to pinpoint the primary challenges confronting informal sector households in the study area. The present study also aimed to provide an accurate picture of urban informal sector households and ensured that resilience is built to reach those who need it most.

2. Literature Review

The UN report on World Urbanization says that the urban population in Asia will double, and it is expected that the percentage of people living in urban areas will increase to 41.4 per cent against the present rate of 28 per cent. The urban disaster vulnerabilities are formed directly by some factors, such as a rise in sea level, flooding, pollution, and toxic and hazardous waste (UNEP, 2007). The people living in urban areas, especially in slum dwellings, are housed in poor-quality and overcrowded houses and lack basic amenities like food, sanitation, and solid waste management. Heavy rain in the area makes them more vulnerable to flooding, destroying their assets, their productivity, and interrupting their national income. This ultimately led to disease and displacement (Judy L. Baker, 2007). The informal workers are disproportionately affected by natural disasters. The working poor, such as self-employed and informal sector workers, affected by the disasters due to climate change, include floods, disasters, heat waves, droughts, pollution, and those workers rely on climate-sensitive resources like water, electricity, fishing, and agriculture (Jose Vattakkuzhy on Times of India, 2023)

2.1 Availability of Climate Finance

The availability of climate finance is an important component in enabling cities to transition from reactive disaster management to proactive resilience building. In the context of sustainable urban development, the flow and accessibility of climate-related funds determine the capacity of local governments to implement adaptation and mitigation measures effectively. However, the literature shows the availability and barriers of climate finance which provide essential insight into how anticipatory urban governance can be operationalized within resource constrained environment.

Climate change governance is emerging as a significant challenge for policymakers and environmentalists seeking sustainable solutions to climate change finance and crisis (Richard Kwame Adom et al, 2023). This study was conducted in KwaZulu-Natal Province in South Africa. According to this study, Richard Kwame Adom et al. stated that climate change is considered the major challenge for the future and is considered an environmental issue rather than a challenge that involves all aspects of life. Mainly, this paper focused on the weaknesses of structural and governance under climate financing

and administration in KwaZulu-Natal province. They found that the administrative bodies, institutions, and other governance mechanisms addressing climate issues lack the required investments and have weak accountability mechanisms. To avoid this problem, they recommended the cooperation of national and local bodies as well as the private sector in financing and assisting the climate crisis.

According to Aditya Bahadur, Thomas Tanner, and Florence Pichon in the Asian Development Bank working paper, the majority of the world's population lives in towns located in coastal areas, rivers, and hilly areas; therefore, significant risks will be faced by the inhabitants. This study is based on urban climate change resilience in cities. The authors highlighted the growing importance of urban climate change resilience, given the socio-economic vulnerability in urban areas, rapid urbanization with unplanned activities, land tenure issues, and the cities' heightened exposure to climate-related risks. This study recommends strengthening the urban climate change resilience program in cities, such as sharing and updating data on urban growth and climate change. It will help to understand the risks and take initiatives to strengthen urban climate change resilience. The authors suggested that urban infrastructure and urban development will improve urban climate change resilience in cities. Finally, the authors pointed out that to build a stronger urban system, the importance should be given to water, energy, transport, and health.

The Southern African Development Community (SADC) is one of the most vulnerable regions to natural hazards (Christo Coetzee et al, 2023). The study named *"Financing Disaster Risk Reduction: Exploring the Opportunities, Challenges, and Threats Within the Southern African Development Community Region"* focused on disaster risk reduction and funding. It was found that the funds allocated for disaster risk reduction are adequate within the SADC member states under the heads of socio-economic loss, human loss, and infrastructural impacts. This study adopted a qualitative research design and collected 67 data from Botswana, Eswatini, Namibia, South Africa, and Zimbabwe. The collected data were mainly focused on financing DRR, the Cost-Benefit Analysis of DRR, and the impacts of the disasters on the national economy. Through this study, the researchers found that the DRR funding is not adequately served in all member countries consulted in comparison to funding allocated to disaster response. Finally, under the funding of DRR, this study serves as a basis for advocating and endorsing enough DRR funding.

The U.S. Government provides billions of dollars in disaster recovery assistance every year to disaster-affected families and individuals. However, the cost of assistance is increasing rapidly due to the severity of flooding and storms in the USA (Jay et al., 2018, cited in Bradley Wilson et al., 2021). The study by Bradley Wilson, Eric Tate, and Christopher T. Emrich examined the state of knowledge related to flood disaster assistance and recovery for the socially vulnerable population. They said that, yet research examining equity in

disaster assistance increasingly shows that recovery funding underserves vulnerable populations. One of the primary reasons for the adverse assistance of disaster recovery is based on population disparities, such as low-income households, racial and ethnic minorities, who faced the most discrimination and barriers while receiving federal assistance for their disaster recovery. The empirical research showed that the negative financial impacts continue for a longer time, making the affected people more vulnerable and without any additional assistance or financial coverage, the process of recovery is completely ineffective (Gotham, 2014; Muñoz and Tate, 2016, cited in Bradley Wilson et al., 2021)

The media reports and existing studies have highlighted the significant role of government and non-governmental entities in providing aid related to public health and safety following disasters (Daniel Sledge et al., 2019). The Government and Non-Government Entities have a crucial role in disaster recovery and response. They should provide financial assistance and make policies aimed at improving and addressing the socio-economic vulnerabilities of the disaster (Gerber BJ, Robinson SE, 2007 and Egan MJ, Tischler GH, 2012, cited in Daniel Sledge et al., 2019).

2.2 Barriers to the adoption of climate resilience

Building climate resilience not only involves adaptive strategies but also ensuing their effective and comprehensive adoption within policy and practice. However, various financial, social, and technical barriers often limit translation of resilience plans into action. This section clearly reviews the major barriers and constraints that hinder the implementation of climate resilience activity.

Many disasters disproportionately affect poor nations, which lack resilience activities and means to respond to natural hazards. The management of the disaster is influenced by factors such as migration and its impact, demographic issues, and the degree of urbanization (Lee, A.C.K, 2016). He also noted that community engagement is essential for reducing vulnerability to disasters. There are several barriers to disaster risk reduction, as pointed out by Lee, A.C.K (2016) including legal barriers, political barriers, knowledge barriers, and system configuration barriers.

Through the application of the MAO (Motivation, Ability, Opportunity) Theory, Eefje Hendricks and Mia Stokmans studied Drivers and barriers for the adoption of hazard-resistant construction knowledge in Nepal. They said that, despite the frequent natural hazards, the affected people failed to build safer houses to protect themselves from future hazards. The MAO application provided a novel understanding of the aims to build a safer house. Further, the authors noted that the Humanitarian Technical Assistance (HTA) was able to increase the affected community's intention to rebuild a safe house after the

disaster. This technical assistance provided to the communities helps remove barriers to rebuilding the affected houses.

The intensity and frequency of natural hazards are increasing, and the demand for disaster risk reduction governance is increasing; it is urgent to mitigate the intensity of the natural hazards (J. Ahrens, P.M. Rudolph, 2006; C. Choudhary, S.R. Neeli, 2018, cited in Bien Thanh Vu et al, 2025). According to Bien Thanh Vu, the sound governing principles for the reduction of disaster risks are accountability and collaboration: transparency, information sharing, responsiveness, and flexibility. However, the barriers are the gaps in accountability due to the lack of incentives for disaster risk reduction, collaborative efforts are limited from the private side, insufficient distribution of hazard mapping and hazard assessment at the basic community level (Bien Thanh Vu et al, 2025- Enablers and barriers to implementing effective disaster risk management according to sound governance principles: Lessons from Central Vietnam).

Fighting the negative impacts of anthropogenic induced hazards and natural hazards requires comprehensive understandings of their distinct causes and integrated policy and governance responses (Biermann, 2014; Delanty & Mota, 2017; OECD,2007, cited in Shafaq Masud and Ahmad Khan, 2023). According to Shafaq Masud and Ahmad Khan, in the case of Pakistan, the barriers to implementing better governance for reducing vulnerability and disaster risk are that policy development is an open or closed consultation process, the policy is seen as a generic document for specific action, and policy administration is a central or devolved process. These issues resulted in a deprived understanding among the policy makers and false policy expectations towards the disaster risk reduction (Shafaq Masud & Ahmad Khan, 2023).

The mitigation of climate change challenges is a matter of central policy involvement. Its adaptation involves the public bureaucracy (Robbert Biesbroek et al., 2018). According to Dupuis & Biesbroek (2013), adaptation is defined as the intentional policy measures taken by private or public entities to mitigate the vulnerability of policy sectors, societal groups, or climate change risks.

2.3 Urban Climate risks and informal settlements

Informal settlements is one of the most vulnerable urban spaces to climate related risks due to the high population density, poor infrastructure, and poor health conditions. Understanding the dynamics between informal sectors in urban slums and climate resilience is essential to address the deepened challenges of urbanization, poverty, and environmental change.

The study titled “From risks to resilience: Action research into informal workers’ health and wellbeing in Indore, India,” Siddarth Agarwal., et al. (2022) found that the growing informal workers basically live in informal settlements with more squeezed and congested facilities. They said that the growing population, weak infrastructure, climate, and health hazards led to difficulties for informal workers and settlement dwellers.

Md. Humayun Kabir et al. (2017) used a model called the Urban Disaster Resilience Index (UDRI) model. Under this model, the researchers integrated infrastructural, institutional, social, and economic resilience. The study was held in the Dhaka North City Corporation. Based on their results, the overall UDRI index increased from 2.35 (2010) to 2.52 (2016). It showed that a notable increase in resilience occurred across the infrastructural, institutional, social, and economic sectors.

According to David Satterthwaite et al (2020), informal settlements in urban areas are poor-quality shacks or houses built outside the formal regulations and laws of a nation. The various informal settlement upgrading and promotion programs can reduce the risks by reducing exposure to natural hazards and boosting the knowledge of disaster resilience among the vulnerable people. To transform an informal settlement into a formal human settlement, the urban or city government reduces the cost of land and permits, improves the facilities for basic amenities like water, drainage, sanitation, and electricity (Rojas, E. (2018) cited in David Satterthwaite, et al (2020). More than half of the global population lives in urban areas, and this concentration needs well-developed and informed actions to cut greenhouse gas emissions and further climate-related risks (David Dodman et al, 2019).

2.4 Socio-Economic Factors and Vulnerability

Socio-economic conditions play a crucial role in shaping the degree of vulnerability to the risks of climate-related hazards. Factors such as weak infrastructure, poverty, and limited capacity to coping mechanisms often increase the adverse impacts of climate-related hazards, especially in developing regions. This section reviews some important studies that show how the socio-economic indicators are related to the vulnerability and resilience in the context of natural hazards.

Risks related to climate contribute to poverty in three ways: ex-ante risk management, ex post coping responses, and the tendency for risk tolerance. (Carter and Barrett, 2006, cited in James Hansen, et al., 2019). It means that the risks related to climatic conditions cause rural poverty by curtailing investment due to the fear of asset loss when a disaster occurs, thereby undermining long-term livelihood. The existence of rural poverty in these environments proposes poverty reduction pathways that show the impacts of risk management interventions (James Hansen et al., 2019).

The socio-economic trends in developing countries are characterized by high vulnerability to climate risks. The Less Developed Countries are mainly affected by extreme levels of poverty, weak economy, lack of economic and physical resources, and poor infrastructure. This physical character, combined with socio-economic factors, led the Less Developed Countries to a high level of exposure to climate change and climate vulnerability (UNFCCC, 2008). According to Olga Zakharova, the socio-economic vulnerability related to climate change depends not only on the risk of climatic hazards but also on the capacity for coping. The risks associated with such vulnerabilities are that old and unsafe buildings are more susceptible to climate hazards (Prall, M.C.; Brandt, U.S.; Halvorsen, N.S.; Hansen, M.U.; Dahlberg, N.; Andersen, K.J., cited in Olga Zakharova et al., 2025). The overall socio-economic risk is increased by the hazards which destroy water, electricity, telecommunication, and other dependent sources (Cutter, S.; Boruff, B.; Shirley, W., Social, cited in Olga Zakharova, et al., 2025).

3. Methodology

The present research aims to examine the resilience incentives among informal sector households in disaster prone cities located in southern part of India. The study adopts an interdisciplinary approach, integrating social, economic, and environmental perspectives to achieve a comprehensive understanding of resilience- building mechanisms within a vulnerable urban context. The study area selected for this purpose is Idukki district of Kerala recognized as one of the most- disaster prone regions in South India. To ensure data precision and representativeness, the sample size was determined based on the number of informal sector households affected by natural hazards within the district. A total of 312 households were selected using a multistage sampling method. The sampling distribution was structured according to types of informal employment prevalent in the study area. The study is entirely based on primary data, collected through a structured interview schedule, and face-to-face interviews with respondents. The survey method was employed to gather relevant information regarding exposure to hazards and adaptive mechanisms.

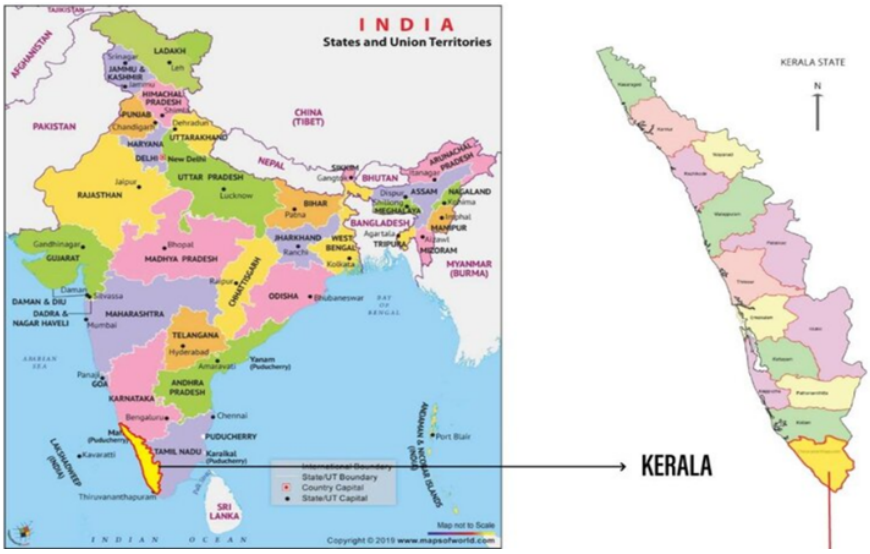
The specific research objectives are.

1. To identify the key gaps in the availability of climate finance targeted at informal sector households in urban areas, particularly with resilience-building activities.
2. To evaluate how climate resilience incentives, such as microloans, subsidies, and direct cash transfers, help to stabilize income and reduce poverty of households working in informal sectors.

3. Analyzing the barriers (lack of awareness, access to information, bureaucratic hurdles) to the adoption of climate resilience incentives in the informal sector in different cities.
4. To examine how the socio-economic factors affect the vulnerability of urban inhabitants to climate-related risks.

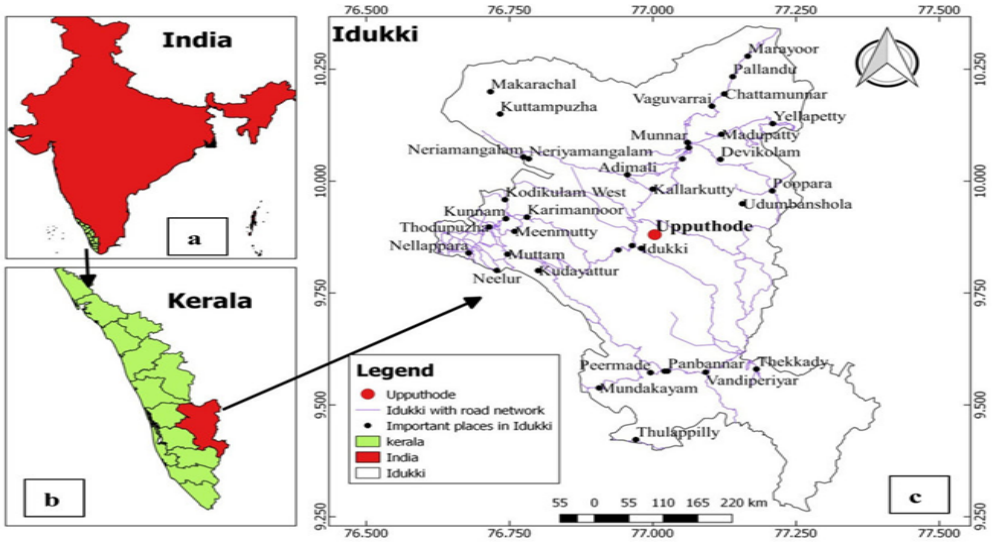
3.1 Area of the Study

Map 1: Locating India and Kerala



The state of Kerala in India was hit by extreme and violent disasters and floods in 2018, 2019, 2020, and 2021. The state of Kerala is situated in the southern part of India. In recent years, Kerala has been affected by various natural hazards, including floods, heat waves, and other severe weather events. It is considered one of the hot spots of natural hazards in South India. Especially in Kerala, the hilly regions are most affected by natural disasters, including flash floods, heavy rain, and extreme weather events. Based on this notion, one of the most significant and disaster-prone areas in South India, situated in Kerala, named Idukki, is taken as the study area of the research. In 2018, over 1000 disasters were reported in the single district of Idukki, along with massive rain and flash floods. Over 177 casualties were reported during this incident. It was considered one of the most significant disasters in the history of Kerala. The overall economic loss regarding this incident was $5.6 billion, according to the government of Kerala. Likewise, in 2021, 2022, 2024, and 2025, the incidents of floods and disasters continued in the Idukki district of Kerala. So, the selection of this place as a research area of the study is highly justifiable.

Map 2: Locating Kerala and Idukki District



The Idukki district lies in Kerala between 9° 15' and 10o 21' of North latitude and 76° 37' and 77° 25 of East longitude. The district is very famous in India for the cultivation of tea, coffee, cardamom, and pepper. The district was coming into existence based on notification number 54131/C2/71/RD on 26th January 1972. The name of the district Idukki emerged from the word "Idukku", which means narrow. The word also reflects the physical condition of the district, as the majority of the area is characterized by narrow, hilly terrain. The total geographical area of the district is 436345 square kilometers, which places the district as the second largest in Kerala State. The district lies mainly between two physiographic divisions, the highland, and the midland.

3.2 Research Design

Interdisciplinary Research

This research adopts an interdisciplinary approach to achieve its objectives, which encompasses socio-economic and environmental outcomes. Social and economic challenges cannot be effectively addressed through scientific perspective alone, rather they require integration with socio-economic and environmental dimensions. Therefore, steering the research through an interdisciplinary framework is essential to ensure a comprehensive and sustainable solution.

3.3 Approach of Analysis

Socio-Economic Analysis

To study the impacts of natural hazards on the households of the informal sector in the study area, an approach to socio-economic aspects was used. The factors behind this approach are considered as variables like age of population, educational status, income status, employment status, housing pattern, acceptance of risk, character of the living area, direct cost and indirect cost, replacement cost, prevention cost, micro, and macroeconomic costs.

3.4 Sampling Design for Field Work

To obtain precise data on the vulnerability of informal sector households to natural hazards, the Idukki district of Kerala in South India was selected. The number of samples was selected based on the number of affected informal sector households affected by floods and disasters in the district. The district includes five taluks and eight blocks. Out of the five taluks, the three most affected taluks were selected, with a focus on the urban zones in these areas. The total sample size of the study was 312 through a multi-stage sampling method. The primary data survey was conducted in the study area to evaluate the losses regarding the disasters in different aspects of the households of the informal sectors in the study area.

3.5 Sampling Distribution of the Study

The sampling distribution of this study was based on the type of informal households in the study area. The types of households were categorized based on the informal work done by the targeted sample group in each study area.

Table:1 Sampling Distribution

	Types of sample participants from the study area				
Sampling Areas	Rural job scheme workers	Daily wage agriculture labourers	Manual Haulage Workers	Others	Total
City 1	22	0	33	30	**85**
City 2	36	10	56	80	**182**
City 3	12	0	21	12	**45**
Total	**70**	**10**	**110**	**122**	**312**

Source: Primary Data

3.6 Methods for data collection

The survey method was used to collect data from the study area. This study is purely based on primary data, and the data was collected with the help of a structured interview schedule and face-to-face interviews with the respondents in the study areas.

3.7 Variables and statistical tools used for the study

Objective of the study	Significant variables used for the analysis
1. To identify the key gaps in the availability of climate finance targeted at informal sector households in urban areas, particularly with resilience-building activities.	Government assistance, satisfaction with the government resettlement, Reasons for dissatisfaction with the government resettlement, respondents' opinions on the government resettlement's failure to choose beneficiaries.
2. To evaluate how climate resilience incentives, such as microloans, subsidies, and direct cash transfers, help to stabilize income and reduce poverty of households working in informal sectors.	Government assistance on house amount, Government assistance on land, Government assistance on crop loss, Government assistance on others, Loans for house reconstruction, Loans for house maintenance
3. Analyzing the barriers (lack of awareness, access to information, bureaucratic hurdles) to the adoption of climate resilience incentives in the informal sector in different cities.	Respondents' opinion on government resettlement is a failure. Respondents' satisfaction level on government assistance, opinion of respondents on govt participation to reduce the damage, Types of occupation (Informal worker types), Name of the area (regions)
4. To examine how the socio-economic factors affect the vulnerability of urban inhabitants to climate-related risks.	Economic risk faced at the time of disaster, Environmental risk faced at the time of disaster, Psychological risk at the time of disaster, Changes in, Land pattern after the disaster, earnings before disaster, Earnings after the disaster, Area before the disaster, Area after the disaster, Difference in land loss before and after in cents washed off, distance category, actual plot price, actual proximity, Cost on house damage, Cost on damage on property loss, Loss of income from employment, Main water source of the household, Water source polluted, loss on sanitation facilities,

	Type of demolition, Damage cost on the loss of sanitation facility, Reconstruction cost on sanitation facility, Annual income before disaster whole, Annual income after disaster whole, Whole income difference before and after disaster

A strong statistical analysis was conducted using descriptive statistics, including frequencies, percentages, means, and contingency tables. The tools, such as the t-test and analysis of variance, were used for the in-depth analysis of the study.

3.8 Data Analysis

Mainly, the data collected was analyzed based on the objectives of the study. The analysis was categorized into four parts based on four objectives. The significant variables are classified under the characteristics and needs of the study. The selected objectives are different themes, based on which the analysis of the study was done thematically into four parts. The central part of the analysis focused on government assistance after the disaster, respondents' satisfaction with this assistance, and the economic and social losses resulting from the disaster, compared before and after the disaster. By analyzing all the variables, we can gain a comprehensive understanding of how the disaster affected the informal sectors in the study area. The results will go beyond the prescribed objectives of the study, which means more clarity will be gained in this area. The analysis of the study was done with the help of SPSS.

3.9 Ethical consideration

This research was conducted with strict adherence to ethical principles to ensure the dignity, rights, and well-being of all participants. Informed consent was obtained from all respondents after clearly explaining the purpose of the study, their voluntary participation, and their right to withdraw at any time without any consequence. Special attention was given to vulnerable groups, including women, elderly individuals, and those experiencing trauma due to the disasters. Privacy and confidentiality were maintained by anonymizing data and securely storing all collected information. No personal identifiers were used in any reports or analyses. A study was designed to minimize any psychological distress, and participants were treated with empathy, respect, and cultural sensitivity throughout the data collection process.

4. Results and Findings

The results of the study are presented using tables, figures, and their descriptions. The detailed findings are discussed in the discussion section of the study.

4.1 Socio-Demographic Profile of the Respondents

Table: 2

Indicators	Classifications	Total (N=312)
Family Type	Nuclear	287 (92)
	Joint	25 (8)
Type of House	Sheeted	99 (31.7)
	Tiled	105 (33.7)
	Terraced	108 (34.6)
Ownership	Own	305 (7.8)
	Rented	7 (2.2)
Education	Primary	138 (44.2)
	Secondary	98 (31.4)
	Graduate	76 (24.4)
Poverty Line	APL	179 (57.4)
	BPL	133 (42.6)
Income Level	Low	80 (25.6)
	Middle	162 (51.9)
	High	70 (22.4)
Current Living Area	Less disaster-prone area	74 (23.7)
	Disaster-prone area	238 (76.3)

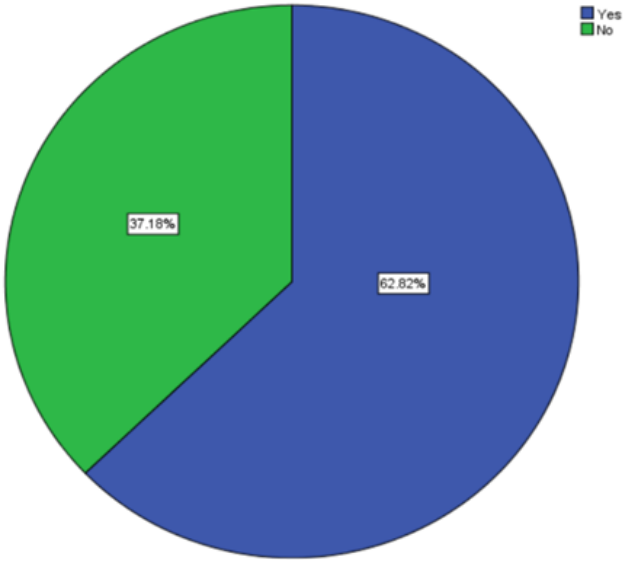
Source: Primary Data

The table shows the demographic details of the respondents in the study area. The majority of the respondents in the study area belong to the nuclear family under the head of family types. That is 287 respondents belonging to this category. Only 25 respondents live in a joint family. Most homes contain an average of only two members, and this is a nuclear family. 34.6% of families have a terraced house, and 31.7% of people have a semi-detached house. The term "Terraced house" does not imply that those people are living safely, as most of these houses are still located in disaster-prone areas. The level of education among the respondents is low, with 44.2 per cent falling under the primary education category, indicating a lack of knowledge about the intensities of disasters. Another important aspect is the current living area of the respondents. Following the massive flood, flash flood, and landslides, the majority of residents remain in the prone area, comprising 238 households out of our total sample of 312, or more than 50 per cent

of the sample population. It is the basic idea of the demographic details of the respondents who were affected by the disaster recently.

4.2 Did the respondents receive disaster-resilience incentives?

Figure 1: Pie Diagram of respondents who receive the disaster resilient incentives



The pie chart deals with information regarding the respondents who received disaster-resilience incentives after the natural hazard occurred in their regions. According to this diagram, 62.82 per cent of the respondents did not receive any government assistance after the disaster for rebuilding and repair purposes. Only 37.8 per cent of the respondents received some money in the form of incentives from the authorities. It shows the failure of the authority to treat the affected residents correctly. Those residents are still residing in the disaster-affected regions.

4.3 Level of satisfaction of the residents with financial incentives for disasters

Table: 3

Opinion	Satisfied	Moderately Satisfied	Not Satisfied	Total
Frequency	77	18	217	312
Percentage	24.7	5.8	69.6	100

Source: Primary Data

The table shows that 69.6 per cent of the residents are not satisfied with the financial incentives given by government authorities. It is a big problem in the study area. The primary reasons for dissatisfaction are shown below.

Table: 4

Opinion	No Government Incentives	Incentive is not enough	Satisfied with incentives	Total
Frequency	119	101	92	312
Percentage	38.1	32.4	29.5	100

Source: Primary Data

The primary reason for the dissatisfaction is that the government did not give any assistance to the affected residents in the study area. One hundred and nineteen residents raised this opinion. Another reason is that the incentive given is insufficient to support their resilient activities. In the study area, all the sample residents lost their homes and land, so the given amount does not fill the gap between the loss and the assistance money from the government. In essence, a significant disparity exists between the socio-economic losses and the financial incentives provided by the respected authority.

4.4 The gap between loss and financial incentives

Table: 5

Loss and Incentives	House Damage	Incentives for House	Land Loss	Incentives for Land
Average	86157.05	297739.13	375509.63	502963.63
N	312	115	312	55

Source: Primary Data

The average loss from house damage is 86157.05 rupees, and the government fund allocated for this purpose is 297739 rupees. It seems much better, but the problem is that out of the 312 sample respondents, only 115 respondents were assisted by the government with the financial incentives for the house damage; the rest of them failed to grab the funds for house reconstruction. The same case is repeated in the case of land loss. A significant disparity exists between the affected households and those assisted by

the government in terms of land loss within the study area. It shows the incentives given by the government after the disaster for resilient buildings have failed.

4.5 How to fill the gap?

In the study area, the researcher observed that affected residents are either undercompensated or are experiencing delays in receiving financial support. It is a common challenge, especially in developing countries or regions with limited resources and inefficient policy mechanisms. To bridge the gap between disaster losses and incentives, the concerned authority must adopt a blended approach that combines social resilience with financial preparedness. The incentives should be adopted through pre-arranged funds, a public-private partnership. The key mechanism is the transparent assessment of damage to affected households and a clearly legislated compensation mechanism. It can expedite the recovery from disaster shocks in these regions. The action of local government is the primary power to act swiftly against disaster risks, and they ensure the transparency of disaster incentives to affected households. On the technical side, the improvement of data systems for tracking aid further closes the assistance gap and builds public trust. The involvement of the private sector will be helpful in this case.

4.6 Financial Incentives and Economic Security

Table: 6

Loans taken	N	Average Amount
Loans for house reconstruction	72	260625.15
Loans for house maintenance	312	5096.15

Source: Primary Data

Here, the affected households take out loans for the reconstruction and maintenance of their destroyed shelters. The government provided no separate loans for these purposes. The majority of respondents believed that the loans for house reconstruction led to financial instability after the hazard, as the loan repayments became an unattainable dream. According to this table, 72 respondents took loans for house reconstruction, which is an average of 260625 rupees. In the case of maintenance, the amount of money is small, averaging 5096.15 rupees, but is taken by all the respondents in the study area.

4.7 Direct cash incentives from the Government

Table: 7

Direct Cash from Government	N	Average Amount
Government assistance for the House	115	297739.13
Government Assistance on Land	55	502963.63
Government Assistance for Others	50	15940.08

Source: Primary Data

The table analyses the picture of direct cash to the respondents after the disaster. More than half of the sample respondents were not satisfied with these incentives given by the government. The primary reason for this dissatisfaction was the gap between loss and financial incentives, and another reason was that the government system did not assist the respondents. The average amount given by the government for a house is 297739 rupees, and 502963 rupees for land, respectively; it was considered low according to the opinion of the respondents.

4.8 Stability of Income

The income stability of the households was significantly disrupted after the disaster; the entire economic structure of the affected area was severely impacted, affecting each household in the area. The loss of the house, land, and other assets had a profound impact on economic stability. It was analyzed using the annual income of households before and after the disaster.

Table: 8

Annual Income	N	Average
Annual income before	312	172757
Annual income after	312	132573.05

Source: Primary Data

The table postulates the annual income of the respondents. Before the disaster, the annual income was 172,757 rupees, but it has since declined to 132,573 rupees. The insight of the table is that the respondents are in poverty and struggling with proper income sources. The ravage of the disaster continuously hit the informal working system of each household in the study area.

4.9 Economic Loss and the Financial Incentives: The Gap

Table: 9

Particulars	Amount in INR

Average Economic Loss	646689.23
Average Financial Incentives	309847.07
Incentive Gap	336842.16

Source: Primary Data

While looking into this table, we can see a huge incentive gap of 336842 rupees (average) to each affected household. The average economic loss was 646689.23 rupees, and the financial incentives were only 309847 rupees. It highlights the government's failure to provide disaster relief assistance to the affected people.

4.10 Disturbance in the equality of income among the respondents

Table: 10

Particulars	Gini Coefficient
Income Inequality Before	0.27
Income Inequality After	0.33

Source: Primary Data

The table examines the changes in income equality among respondents in disaster-affected regions. Before the disaster, the Gini value was 0.27, but it increased to 0.33, indicating a rise in income inequality. Consequently, the respondents faced economic instability after the disaster due to the lack of incentives. Natural hazards significantly worsen income stability and equality, especially for the poor and vulnerable populations, by damaging assets and increasing expenses after the disaster (Regina Pleninger, 2022).

4.11 Barriers to Climate Resilience Incentives

Table: 11

Barriers to Climate Resilience Incentives							
City	**Inadequate Planning**	**Implementation Mechanisms**	**Lack of Awareness**	**Deliberate Avoiding**	**Political Barriers**	**No Issues Faced**	**Total**
1	10 11.8%	15 17.6%	15 17.6%	10 11.8%	5 5.9%	30 35.3%	85 100.0%
2	15 8.2%	39 21.4%	34 18.7%	17 9.3%	31 17.0%	46 25.3%	182 100.0%
3	5 11.1%	5 11.1%	5 11.1%	4 8.9%	5 11.1%	21 46.7%	45 100.0%
Total	30 9.6%	59 18.9%	54 17.3%	31 9.9%	41 13.1%	97 31.1%	312 100.0%

Source: Primary Data

The establishment of good climate disaster incentives is based on principles like accountability, collaboration, information sharing, transparency, autonomy and decentralization, responsiveness, and flexibility (Bien Thanh Vu et al., 2025). In the study area, the primary reasons for the barriers are shown in the above table. Among the reasons for the correct implementation mechanisms and the lack of awareness of the respondents about disaster incentives are the highest proportions. Political barriers are also an alarming issue. The respondents' lack of knowledge about the incentives for disaster loss has been directly observed by the researcher in the field. They did not submit any documents to get assistance from the authorities due to their limited knowledge. The problem is that there is no one there to assist these individuals in obtaining their government incentives. Here, the failure of the local government is the main reason.

Why were the proper beneficiaries not selected for disaster incentives?

According to the opinions of the respondents in the study area, the government authority failed to choose the correct beneficiaries for disaster incentives. They failed to coordinate with the people who were affected by the disaster. Another reason is a lack of transparency. An alarming issue is that the majority of respondents were abruptly assisted by the government, which has some direct connections with the political parties. Still, the people in the affected areas are not assisted by the government, and they said that their applications are still pending under review by a higher authority. The table is shown below.

Table: 12

Reasons for selecting the proper beneficiaries for incentives are flawed.					
City	**Lack of transparency**	**Inevitable community expectation**	**Lack of Coordination**	**No Issues Faced**	**Total**
1	30 35.3%	1 1.2%	24 28.2%	30 35.3%	85 100.0%
2	54 29.7%	7 3.8%	75 41.2%	46 25.3%	182 100.0%
3	8 17.8%	0 0.0%	16 35.6%	21 46.7%	45 100.0%
Total	92 29.5%	8 2.6%	115 36.9%	97 31.1%	312 100.0%

Source: Primary Data

4.12 Respondents' satisfaction

Table: 13

Respondents' opinion on satisfaction with resilient incentives					
City	**Fully satisfied**	**Satisfied**	**Moderately satisfied**	**Not satisfied**	**Total**
1	16 18.8%	9 10.6%	8 9.4%	52 61.2%	85 100.0%
2	15 8.2%	30 16.5%	14 7.7%	123 67.6%	182 100.0%
3	10 22.2%	6 13.3%	1 2.2%	28 62.2%	45 100.0%
Total	41 13.1%	45 14.4%	23 7.4%	203 65.1%	312 100.0%

Source: Primary Data

This table shows the respondents' satisfaction level with the government incentives for the affected people. 65.1% of people who are not satisfied with the incentives provided by the government. Among them, a significant portion of the population did not receive any assistance, including direct cash, houses, or land. The fully satisfied categories received a new house and land in a new, safe location, which has left them fully satisfied with the government's disaster-resilience efforts. Some respondents reported receiving funds to build a new house; however, in the current situation, the money they have received is insufficient to complete the house entirely. It is also a cause for dissatisfaction among the affected communities.

5. Socio-Economic Factors and the Disaster

Under this section, the study examines several factors, including poverty levels, housing patterns, family types, and proximity to disaster zones, to investigate the relationship between disasters and socio-economic factors. After this, the researcher tried to include the whole loss scenario of the study area.

5.1 Level of poverty and the disaster loss

Table: 14

Poverty Line	House Damage	Land Loss	Income Loss	Distance from Prone Area
APL	102125.69	354100.55	23162.04	3.89

BPL	64665.41	404323.35	28832.48	2.70

Source: Primary Data

The table shows the differences in damage and loss among the APL (Above Poverty Line). According to the data, the BPL (Below Poverty Line) people suffer the most. They are residing very close to the disaster-prone area. The researcher found that most of the respondents in the study area under the BPL group, residing very close to the origin of the landslide, faced huge economic impacts in the form of loss of house and land. There is a question: why did they choose that place? The primary reason is the low purchasing cost of land, and they are not aware of the proximity to disaster-prone areas. It is proven with the help of an independent sample t-test.

The vulnerability of living conditions means that these families are exposed to frequent landslide areas. It can be identified through the proximity of their house to the event place. Generally speaking, the BPL families are living in more vulnerable or high-risk areas when compared to the APL families. In many ways, natural disasters disproportionately affect the poor, who are more exposed to natural shocks (Stephanie Hallegatte et al., 2020). Based on this, it should justify that there is a difference in the living conditions of the APL and BPL households with respect to environmental vulnerability to landslides based on the proximity of their houses to the event place. For this, the t-test has been used to test the hypothesis. The result says that the average proximity of the BPL families to the landslide event is only 2.7 km. In the case of APL families, the proximity is much higher, that is, an average of 3.8 km. The value of the land is another factor showing the vulnerability of the place. The average prices of the land where BPL and APL families reside are 39767 and 47793 rupees, respectively. This result suggests that BPL households are living in more vulnerable areas compared to APL households. Finally, there is a difference in the vulnerability of living conditions with respect to the BPL and APL households. The test results of the independent sample t-test are shown below.

Table: 15

Group Statistics					
Distance of the household from a high-risk area	**Poverty Line**	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
	BPL	133	2.70	3.02	0.26
	APL	179	3.89	3.75	0.28

Independent Sample T Test			
Proximity and the Land Values of APL and BPL	**Levene's test for equality of variances**	**t-test for Equality of Means**	**95% confidence interval of the difference**

		F	sig	T	df	Sig (2-tiled)	Std error Difference	Lower	Upper
Proximity of the house to a prone area	Equal variance assumed	10.455	.001	-3.00	310	0.003	0.39	-1.97	-.41084
	Equal variance not assumed.			-3.10	308	0.002	0.38	-1.94	-.43478
Land Value	Equal variance assumed	18.632	.000	-23.4	310	0.20	3421.75	-14759.17	-1293.58
	Equal variance is not assumed.			-2.42	308	0.16	3314.58	-14548.47	-1504.28

Table: 16

5.2 Housing pattern and loss

Table: 17

Type of House	Descriptive Statistics	Oldness of the house	Cost of house damage	Total Loss
Sheeted Roof	Mean	23.78	36860.60	376736.12
	N	99	99	99
	Std. Deviation	12.85	39022.26	435029.65
Tiled Roof	Mean	31.2095	36631.4286	407058.84
	N	105	105	105
	Std. Deviation	14.98	53535.08	455004.04
Terraced Roof	Mean	6.88	179495.37	954580.33
	N	108	108	108
	Std. Deviation	8.55	232770.80	966005.14
Total	Mean	20.43	86157.05	586963.88
	N	312	312	312
	Std. Deviation	16.08	157184.02	722392.02

Source: Primary Data

The table illustrates how different types of housing exacerbate the financial burden on informal sector households in the study area. One hundred and eight residents own terraced houses that are 20 years old, compared to the others. That group of people faced

more damage than the others. It is only because of the style of the house. When a disaster strikes, housing is a significant concern for residents, affecting both the damage to their homes and the time it takes to recover. It mainly depends on the types of houses the people own (Sara Hamideh, et al, 2021). The insight from this table suggests that terraced houses, due to their shared structure and proximity to the disaster area, are more likely to experience widespread damage after the disaster compared to tiled or sheeted houses.

5.3 Family type, Family size, and Disaster Loss

Table: 18

Family Type	Descriptive Statistics	Total Loss	Family size
Nuclear	Mean	559102.96	3
	N	287	287
	Std. Deviation	695827.03	1.267
Joint	Mean	906807.16	6
	N	25	25
	Std. Deviation	936327.72	.707
Total	Mean	586963.88	3
	N	312	312
	Std. Deviation	722392.02	1.553

Source: Primary Data

The table clearly defines that the family with more members (a joint family) is affected most by the disaster in the study area. They faced a massive loss of an average of 906807 rupees. In the study area, the average number of family members in an informal household is six. Those who live in a joint or extended family have a different experience compared to the nuclear family. Their disaster preparedness is different from that of people in a nuclear family type (Mishra & Suar, 2005, cited in Sasmith Mishra and Damodar Suar, 2005).

5.4 The Total Loss to the Informal Households in the Study Area: An Economic Analysis

The total losses to all informal households due to the disaster in the study area. According to the study, the highest loss is coming under the head of land loss, that is 117159006 rupees. House damage is very close to land loss, which amounts to 268,810,000 rupees. Other notable losses include loss of income, loss of agriculture, and loss of sanitation facilities such as latrines and other toilet facilities in households. Considering this significant loss, the main issue for the respondents is the reconstruction of these

destroyed items. They spent a tremendous amount of money from their own hand for the reconstruction apart from the government's incentives. The details are given below.

Table 19

List of losses faced by the households	Amount in rupees (% of total loss)
house damage	26881000.00 (14.67)
Land loss	117159006.00 (63.97)
Loss on furniture	2567200.00 (1.40)
Loss on home appliances	1488700.00 (0.81)
Loss on food grains	372900 (0.20)
Loss of income from employment	7728630.00 (4.21)
Health cost	169300.00 (0.09)
Loss of offensive measures	5666200.00 (3.09)
Cost of agricultural loss	11538015.00 (6.29)
Cost of animal husbandry loss	1453450.00 (0.79)
Loss on water facilities	986630.00 (0.53)
Loss of sanitation facilities	5249500.00 (2.86)
Other losses	1883200.00 (1.02)
Total Loss	**183143731.00**

Source: Primary Data

5.5 The cost of repairing

Table: 20

The cost of repairing spent by the households	Amount in rupees
Roof	20276470.00
Electricity	1836100.00
Walls	16149100.00
Furniture	1613500.00
Kitchen and appliances	1160100.00
Sanitation and water	4823300.00
Defensive measures	3464000.00
Others	2147200.00

Total Cost	**51469770.00**

Source: Primary Data

The table deals with the repair cost or the reconstruction cost incurred by the informal sector of households in the study area. The breakdown of their spending cost reveals that they spent only on building a new house. The highest spending amount is allocated for the roof, walls, sanitation, and defensive measures against potential future disasters. The reconstruction phase of many houses was not completed due to a lack of government assistance and the respondents' financial instability. Most of the houses were stopped in construction halfway due to financial distress. The reason for this issue is the lack of funding, and the given amount is not enough for building a new house in the present economic situation.

5.6 Disaster Loss Index: Interpretation and Implication

A disaster loss index was constructed for this study based on the losses experienced by the respondents in the study area. For the construction of this, the significant variables include house damage, land loss, income disturbances, damage to the sanitation facilities, reconstruction cost, satisfaction with govt resilience, and total loss. The detailed picture of the constructed index is given below.

6. Disaster Loss Index (Dli)

Table: 21

DLI Range	Severity Level	Interpretation
0.00 – 0.33	**Mild**	Minor impact of disaster on livelihood, property, and access to services
0.34 – 0.66	**Moderate**	Noticeable economic or physical disruption; some risk to lives and assets
0.67 – 1.00	**Severe**	Significant losses, high vulnerability, possibly displacement, or long-term disruption

While analyzing Table 22 (given below), it is possible to see that many of the respondents were under the "***Mild***" severity level under each head of disaster damage. However, it does not mean that they are affected less and need a re-interpretation of the term "***Mild***" in connection with the economically marginalized context.

Table: 22

Loss Type	Severity Level	Number of Samples	Percentage
Loss of a house is more than just structural damage — it represents the loss of shelter, safety, dignity, and a family's sense of stability.			
House Damage	Mild	294	94.2
	Moderate	13	4.2
	Severe	5	1.6
Loss of land is more than just value — it may affect shelter, farming, or inheritance.			
Land Loss	Mild	167	92.8
	Moderate	11	6.1
	Severe	2	1.1
A day of lost income can mean survival risk for the economically poor.			
Income Disturbances	Mild	168	53.8
	Moderate	70	22.4
	Severe	9	2.9
Toilets and water facilities may have low asset value, but high health impact.			
Damage to Sanitation Facilities	Mild	114	36.5
	Moderate	33	10.6
	Severe	2	0.6
Even low-cost houses can cause a high burden if savings and support are limited.			
Reconstruction Cost	Mild	224	71.8
	Moderate	55	17.6
	Severe	33	10.6
Low satisfaction with government response reflects not just unmet needs, but a deep sense of neglect, erosion of trust, and perceived inequality in disaster recovery.			
Respondents' Satisfaction with Government Incentives	Low	223	71.5
	Moderate	48	15.4
	High	41	13.1
Total loss is not just the sum of damages — it represents a collapse of security, livelihoods, and the ability to recover.			
Whole Loss	Mild	254	81.4
	Moderate	43	13.8
	Severe	15	4.8

Source: Author's calculation from Primary Data

6.1 Reinterpreting the term "*Mild*" Impact in Economically Marginalized Contexts

The index developed for this study shows that most of the respondents fall under the category of mild, which means they were not affected severely. However, the actual situation is that they were affected severely. On the contrary, a deeper socio-economic interpretation suggests that the severity of impact was profound, especially among

economically marginalized groups. The low index value only reflects the monetary value of the destroyed assets, rather than the actual severity of the destruction they experienced. According to UNDP, *"A poor household losing a modest home may be more severely affected than a wealthy household losing a larger, more valuable home, because the former loses a higher proportion of their total assets and may lack insurance or recovery support."* (UNDP, 2004). Reducing Disaster Risk: A Challenge for Development. United Nations Development Program. It points out that the apparent limitation of the monetary-based composite index and monetary-based loss calculation is that it provides further financial incentives to the affected poor people. Another issue is the assessment of vulnerability experienced by poor people in the study area. It cannot be measured solely in terms of pure monetary values. So, vulnerability is not simply a monetary loss; it deals with the affected people's capacity to resist, cope, and recover from the hazard (Wisner et al, 2004). Finally, the categorization, ***"Mild"*** loss, is numerically and statistically significant and accurate, but it must be interpreted carefully. It must highlight the economic situations of poor people and the non-economic indicators among long-term income populations in disaster-prone areas.

7. Discussion

The study highlighted the impact of natural hazards on households in the informal sector. The study primarily sought to reveal the devastating impacts of disasters on the socio-economic well-being of poor, informal sector households in the study area. The discussion part of the study primarily focused on several key areas, including financial incentives for disaster impact, the gap between disaster impact and incentives, barriers faced by respondents, the level of poverty and disaster, income inequality among respondents, and the preparation of the Disaster Loss Index.

In the study, the majority of respondents did not receive disaster-resilience incentives from the government. A portion of 62.82% of the affected people are still experiencing disaster-related losses. The funding of recovery from the natural disaster underserves the affected people in the low-income households, minorities, and renters. Direct assistance from the government is very rarely fully satisfactory to the survivors (Bradley Wilson et al., 2021). K. M. Ali Reza et al. (2024) proved that underfunding or low financial incentives from the government lead to prolonged recovery periods and severe vulnerability among the affected people in the study area. Notably, a case study of the 2018 Kerala Floods in India reported a significant economic constraint that shortened post-disaster assistance (NIDM, 2018). The floods of 2018 had a direct and significant impact on our study area. In the words of Stephanie Hallegate, a GFDRR lead economist, *poor people need social and financial protection from disasters that cannot be avoided, even with risk policies in places that*

we know to be effective. We have the opportunity to prevent millions of people from falling into poverty.

In the study, one of the major findings reveals a significant gap between the number of households affected and the number of people who received disaster incentives from the government. Table 06 shows that a total of 312 households were severely affected, but only 115 and 55 households got assisted with shelter and new land, respectively. The disaster recovery and incentive program failed to reach the truly vulnerable households affected by the disaster loss, especially low-income households (Digital Dialogues, 2019). In the study area, no households have any disaster insurance due to poor access and affordability. Markhvida et al. (2020) note that the new era of insurance aims to mitigate the economic risks associated with disasters. However, for poor households, accessing information about insurance schemes and government grants is challenging, and they often encounter bureaucratic hurdles. The following case is affordability, meaning the insurance premium is too costly for low-income families. According to government officials in disaster-affected regions, informal sector households received government incentives for houses and land, valued at INR 400,000 and INR 600,000, respectively.

However, the study's findings revealed a discrepancy in this claim. The findings showed that the government provided an average of INR 297,739 and INR 502,903 as disaster assistance. In the global scenario, disaster-affected communities receive only 60% of the funds they requested, leaving some significant community needs unmet. Generally, these funding gaps are especially met by high-profile disasters (IFRC, World Disaster Report 2018). The significant consequence of this funding gap is the insufficient disaster incentives for people in need, which reduces the speed of recovery from disaster risk. It will lead low-income households into utter poverty and other disaster risks (K.M. Ali Raza et al., 2024). In the present study, the level of annual income decreased after disasters in the study area. Three primary reasons support the findings, including the destruction of livelihoods, reduced savings, and increased inequality. The ravages of disasters damage houses, land, crops, and other means of production in the area, which drives the drastic collapse of other primary income-generating sources, apart from informal sector activities, and the high cost of recovery actions in the post-disaster period. Likewise, for urban or semi-urban populations, the recovery phase for rural populations is challenging due to their lower income levels (Tingting Zhang et al., 2023).

The level of family income will be low after the disaster, which will directly affect savings and increase financial vulnerability. Another important issue is inequality and disproportionate impact. It is related to the household consumption level. Suppose a family has a high consumption rate, typical of larger families (Joint families or families with more members). In that case, they face difficulties after the disaster, because the reduced

income and savings cannot meet the prior consumption levels of households (Shaoyang et al, 2022). This condition was directly evidenced from the current study during the time of data collection. The reduced annual income of the informal residents after the disaster increased the income inequality in the selected study area. Table 10 showed that before the disaster, the Gini Coefficient was 0.27, but it increased to 0.33 after the disaster. A study conducted in China by Wei Wei Wang and Yi Fan Zhao in 2023 found that, especially in the year following the disaster, provincial income inequality (as measured by the Gini Coefficient) and expenditure inequality increased. It also found that the poorest households were hit the hardest. In Mongolia, the Gini Coefficient rose from 0.49 to 0.61 after the disaster and remained at 0.61, indicating a lasting rise in income inequality (Kaoru Kakinuma et al, 2024).

There are several barriers hindering climate resilience assistance in the study area, including inadequate planning, insufficient implementation mechanisms, a Lack of awareness, deliberate avoidance of funding by households, and political barriers. Among these issues, implementation mechanisms were an important obstacle to resilience assistance. In the current study context, the failure of implementation mechanisms is related to some other barriers. Based on the opinions of the respondents, the first problem with the implementation mechanisms is financial, including difficulties in accessing funds and high upfront costs. One of the most convincing results gathered from the respondents regarding the problems in implementation mechanisms is that behavioral and structural issues show a short-term focus and perverse incentives. Other common issues regarding the implementation mechanisms found in the study area are poor institutional coordination, corruption, and misaligned governance.

The study analyzed the connection between socio-economic factors and disasters, revealing some links between social and economic variables and the aftermath of disasters. The important variables, such as poverty, pattern of housing, type of family, and distance to the disaster-prone area, were used to analyze this connection. Table 13 shows the intensity of loss and the level of poverty of the people in the affected region. According to the study's results, BPL (Below Poverty Line) families suffered the most in terms of land loss and income loss. Apart from their informal sector activities, they cultivated different types of crops. Unfortunately, it is located in high-risk areas prone to landslides and flash floods. During the disaster, all these cultivated lands were destroyed, and the crops were damaged, which directly affected their financial stability due to the massive loss in income from their cultivation. It was significantly higher in BPL families compared to APL (Above Poverty Line) families. The Bengal Famine of 1943 provides significant evidence of massive land loss among poor households, resulting in them becoming landless. Poor households suffered significant damage, and their recovery largely depends on asset ownership. However, they lack the necessary backing assets or

financial resources (Khondoker Mottaleb et al., 2013). The disaster's massive destruction washed out all the assets of poor households, leaving them nothing to recover from it.

The conditions of the housing structure, such as the materials used and the type of family residing in it (single-family or multiple family), are important factors that influence the vulnerability to economic loss during a disaster (Sonali Deraniyagale, 2016). Another case is the type of housing and recovery. The type of house directly affects the recovery phase after the disaster. In the current study, lower-income households residing in more vulnerable areas with poor housing structures for many years faced significant losses and slower recovery times. It is also evident from the study, The Impact of Natural Disaster in U.S Home Ownership' conducted by Tamara L Sheldon and Crystal Khan in 2019. Another important finding of the research is that the joint family faced more economic loss. Some social vulnerability studies indicate that households with a joint family have limited mobility to move, access, or relocate to a safer place, which exacerbates their economic losses after the disaster (Nadeeshani Wanigarathna et al, 2024). The studies from the 2018 Kerala Floods showed that families with more members faced massive disturbances to their income, and the recovery phase was more difficult (Abhinav Narayanan et al., 2019). This evidence provides a strong foundation for the results obtained from the field survey of the current study, which were analyzed by the researcher (Table 16). Tables 17 and 18 present a general overview of total loss and total rebuilding cost under various heads met by the households. The total loss is calculated to be INR 18.31 crores, and the rebuilding cost is INR 5.1 crores.

The analysis of the DLI (Disaster Loss Index) prepared by the researcher (Table 22) yields a significant result, but it is paradoxical in its numerical terms. The Index is a study-specific tool constructed exclusively for this investigation, and which indicates that most households fall under the Mild category, indicating they experienced less vulnerability. However, the Mild category actually suffered significant economic and social losses as a result of the disaster. Several studies that justify this contradiction are presented in the current study. They showed that the low-income or indigent households had lower monetary value assets, such as homes and land. Therefore, their full destruction of assets and economic loss is categorized as Mild. This will result in critical flaws, leading to the affected people not receiving proper disaster incentives from the government, as the government's funds are allocated based solely on monetary values. For low-income or impoverished individuals, the monetary value of their assets is typically low, resulting in low incentives from the authorities (Maryia Markh Vida et al., 2020). Another important context is the distinction between relative loss and absolute loss. Suppose a wealthy family loses a bigger home. In that case, it will not affect their overall economic security in the future because they may hold other backup assets, insurance, and other economic securities. The situation is the opposite for people experiencing poverty; their housing loss

will result in a vast, devastating loss. It means that the “Mild” impact by monetary value will be a life-threatening or altering catastrophe for the poor households (Stephane Hallegate and Brian Wash- The World Bank, Mariya Markhvida et al.,2020). Some literature suggests that monetary-based disaster loss quantification is the sole focus of nudge disaster reduction techniques and loss compensation schemes, which primarily protect the wealthiest and most economically valuable assets. These flawed matrices led to less cost-effective interventions in policies for poorer sections of people affected by the disaster (Stephane Hallegate and Brian Wash, The World Bank, 2021). Another flaw of the matrices is the gaps in the well-being losses vs the asset losses. In one disaster scenario, the asset loss of people with low incomes is just 19% of their whole asset losses, but their consumption loss, or in other words, the well-being loss, is 41%; this gap clearly shows that only monetary loss is measured, and it will not clearly define the term “Mild” category (Markhvida et al, 2020). Currently, in developing countries, the need for multidimensional indices is growing stronger to measure the actual disaster losses to people accurately. It integrates the percentage of people affected by loss of life, loss of consumption, land loss, and house damage. It will help to connect the whole aspect of severe disasters experienced by people across all socio-economic strata. This ensures that monetary terms of loss are not the basis of disaster risk reduction incentives for the needy people (Ahina VP & Meenakshi Rajeev, 2024; Stephanie Hallegate & Brian Walsh, 2024; Mariya Markhvida et al, 2020).

To reduce the vulnerability of disasters among poor, informal, and marginalized households, an approach linked with poverty reduction is important. The strategies are strengthened and diversified to enhance livelihood options, primarily focusing on disaster-resilient livelihood measures that help sustain food and income security, even in the face of hazards (UNDP- International Strategy for Disaster Reduction-2008). Another important disaster reduction technique is to encourage local governments to implement and adopt risk mapping, early warning systems, and food and shelter plans in disaster-prone areas. The innovation of low-cost, disaster-resilient housing policies may help poor people residing in prone areas avoid significant disaster losses (Deping Zhong et al, 2024; ISDR-UNDP, 2008). In conclusion, addressing the disaster vulnerability of deprived households requires a comprehensive plan that incorporates income security, food security, infrastructure, social safety, and other community needs, rather than solely focusing on the monetary loss suffered by households.

7.1 Recommendations and Policy Implications

The main findings and discussions of the study aim to provide important policy recommendations for improving the well-being of poor informal sector households affected by disasters. The primary target of the study was to assess the effectiveness of

government incentives on severely affected households following the disaster. Unfortunately, the government failed to provide enough disaster-resilience incentives to the affected communities. First, the possible recommendation under this field is to establish a targeted and transparent disaster incentive system in the form of DBT (Direct Benefit Transfer). This policy is effective in reducing corruption and prioritizing the most affected communities to receive support first, followed by those in need. It also prioritizes land, shelter, and other rehabilitation for displaced and affected individuals. Implementing schemes like “land for landless” and building affordable housing colonies in safer places would benefit needy households. NGOs, Local Government Authorities, and central government authorities should take initiatives by focusing on timeliness and equality among all vulnerable communities. Fourth, the disaster management authority should establish a ‘Livelihood Restoration Pack' that includes skill training, microloans, and other small financial assistance to support starting a small business or exploring self-employment opportunities. Poor communities in disaster-prone areas often receive the warning system very late, or they deliberately ignore it. During the field survey, the researcher observed this pattern and was commonly reported in the study area. This behavior of the respondents does not reflect a lack of awareness about the hazards, but the structural constraints that restrict poorer families from acting on warnings. With limited evacuation options and no secure means to protect their belonging, households fear losing the assets that sustain their livelihood; thus, the perceived cost of leaving is greater than the perceived risk of staying. Therefore, this pattern shows a major systemic hurdle for disaster risk reduction and warrants deeper policy- focused examination rather than being viewed as a behavioral shortcoming. Lastly, given that the poor are disproportionately affected, it is crucial to provide subsidized micro-disaster insurance schemes to the poorest households in the study area, offering affordable premiums that cover their land, shelter, and employment assets. The effective adoption of these recommended suggestions can help build a more efficient, equitable, and resilient disaster management system in highly disaster-prone areas.

7.2 Limitations of the Study

The present study is not free from limitations. The study was conducted in one of the high-disaster-prone areas in South India, namely the Idukki district of Kerala. The researcher has faced harsh behavior from respondents who are still in disaster-prone areas. The study was limited to the highest-risk area in South India due to time constraints. At the time of data collection, the district experienced severe rain and landslides, resulting in seven reported deaths. The availability of data from the respondents was somewhat limited, which has impacted the analysis of the results, particularly in terms of socio-economic variables and their relationship with the disaster. In the midst of the threat of heavy rain and landslides, the researcher was warned by the local people in the study area.

The research's travel costs were very high due to the difficulty in accessing households in hilly regions, particularly in high disaster-prone areas during heavy rain. To ensure the safety of the researcher and the research assistant, we attempted to complete data collection by evening every day.

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Appendix

IN THE SHADOW OF TREMBLING HILLS: THE VOICE OF THE SURVIVORS.

On August 9, 2018, the Idukki district was engulfed by a deluge of heavy rains, shattering dreams built over years, claiming numerous lives, and fracturing rocks in countless places. This colossal disaster, striking with unprecedented swiftness amid the pouring rain, shattered not just stones and soil, but also the minds and dreams of the local populace. They endured those 15 tearful days as if they had lasted 15 centuries.

The catastrophic event that befell Kerala revealed nature's most terrifying face, silently waiting to claim its victims. Yet, press releases and news reports alone could not fully convey the enormity of the disaster. It was imperative to listen to and witness the painful experiences and tears of those who had to drink from the bitter cup of tragedy. This was one of the primary objectives of my research.

Those were the days when nature expressed its fury in the form of cracked pebbles and gushing mountain waters. Perhaps these are reminders, warnings of the cruelty we inflict upon nature. Whenever we hear the name Idukki, the beautiful mountains come to mind. Beyond that, the brilliant Idukki is abundant with the calm-flowing Periyar River and cardamom groves swaying gently in the wind. Perhaps Idukki should be considered one of the most beautiful places in the world because of its remarkable diversity.

Idukki also has a story to tell—a story of a group of frightened lives. Idukki is a place where the whole scene changes when it rains. When the sky darkens and the wind blows, the mountains tremble, and the minds of the valley begin to shake as well. Anything could happen. Throwing away everything and fleeing to a safe place is the only thought in their fearful minds.

I have heard many such stories. Among those people were some who were sad and crying as they shared their experiences, and others who endured and forgave everything. Many of the discoveries I made were shocking remnants of the cataclysm. I saw a group of people who had lost their happiness somewhere along the way. When a little rain comes, these poor souls—with tearful eyes and broken hearts—have no way to find joy.

While others sit safely sheltered from the torrential downpour, the unfortunate here find comfort only in seeing it all as a dream. Every life is a lesson. That one-month research period taught me that peace of mind and security are the most incredible wealth. There, I saw places where huge rocks had fallen, places where lives had been lost, broken houses, and broken hearts. If you listen closely to that soil, you can still hear groans and feel the pain. The screams of men suffocating in the green earth still echo. One can still hear the cries of nature's ferocity, which has washed away many families without leaving a trace, in that sorrow-filled

atmosphere. In the minds of Idukki's people, the rain continues to fall, the pebbles keep tumbling down, and there is a feeling that nothing ever truly ends.

Each broken stone brought its own loss. Most of the survivors still live there today, but the tragedy has drastically changed their lives. Their financial security and quality of life have all been destroyed. What they need now is not just a strong mind, but also our support and a substantial amount of money to rebuild their lives as they were before.

All the dreams they had accumulated over the lion's share of their lives were washed away in a moment, moments when they felt as if they had been born on this earth by mistake. The state of mind they experience when everything crumbles before their eyes in a storm of destruction is beyond anything we can imagine.

Before 2018, we had never seen such a great disaster. Those were very peaceful times. The torrential rain came without warning and destroyed everything. It took some lives and left others alive. "We don't have the strength to bear another disaster," said one survivor of that tragedy. Many have shared their stories with tears in their eyes. Their losses and sorrows are beyond what a mere study can capture. Yet, their determination to live and rebuild after losing everything is truly admirable, and it's a testament to their strength that we should all support.

It rained heavily during the few days I was there, causing landslides and floods in some places. As both a human being and a researcher, I witnessed firsthand the extent of that initial tragedy. During my stay, six people lost their lives in a landslide in a place called Kokayar.

Despite these tragedies, I moved up and down the mountains, listening to the sorrows of the people. While climbing near some houses, residents warned me not to venture into the hills in such unfamiliar heavy rain, fearing it might endanger my life. Still, I traveled despite the warnings, and everywhere I saw houses trembling with fear—homes built on loose ground, uncertain if they would see the next morning.

At every house I left, one question echoed: Will this study give us a chance to move to a new place? A question full of utter helplessness. I had no choice but to nod quietly. Throughout it all, my mind urged me to help in whatever way I could—and I did.

As each house faced its own struggles, so did the people. Those who lost their homes, those whose crops were destroyed, those who were washed away—everyone suffered substantial financial losses. The poorest among them were those who lived off the land, relying on nature for their survival. And yet, that very nature pushed them into disaster beyond their bearing.

In the one month I spent there, I saw and heard nothing to be joyful about. I realized that Idukki had lost its taste, its smell, and its quality of life. No one spoke out about the miserable

existence there; even the government—which should have stood by them and shared their grief—looked the other way.

With the desire to rest their heads in a safe shelter, they continue to live. They cannot afford another disaster. Holding this truth in their hearts, their fragile boat of life sways in the rain, moving forward with the constant fear that it may sink at any moment.

Dr. Anees Rehman A

(The direct experience of the researcher during the data collection)

THROUGH THE LENS: THE STORY OF SURVIVAL

Photographs taken by the researcher during the time of data collection

The incomplete house of the disaster survivors. Again, they built in disaster-prone areas. However, the construction works have been halted due to a lack of funds.