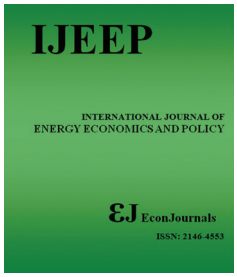

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Impact of Climate Change and Climate Hazzards on Individual Livelihood Vulnerability: Can Climate Finance-backed Initiatives Be a Solution?

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ABSTRACT

Despite its limited resources, Bangladesh currently faces the challenge of minimizing the detrimental consequences of climate change and climate hazards while simultaneously fulfilling its obligations for climate change adaptation. As a result, it is imperative to conduct a comprehensive examination of the efficacy of Bangladesh's climate financing in mitigating its vulnerability to climate change. Thus, this study aimed to investigate the impact of climate change and climate hazards on individual livelihood vulnerability, as well as the mitigation and adaptation strategies enabled by climate finance-backed programs. We have administered a structured questionnaire to 406 respondents from various coastal regions of Bangladesh, including Barishal, Khulna, and Chattogram divisions. Additionally, we have developed 12 hypotheses based on the existing literature to explore the study objectives. With Smart PLS 4.1.0.0, we implemented the PLS algorithm and a bootstrapping test. The study's results indicated that the incidence of climate change catastrophes has a substantial impact on the vulnerability of individuals' livelihoods to climate change, as well as their human, social, financial, physical, and natural capital. Our research also demonstrated that the implementation of measures to alleviate and adapt to climate change and its hazards could potentially mitigate the susceptibility of livelihoods to its adverse effects. At present, Bangladesh's mitigation and adaptation strategies are inadequate. The implementation of methods to mitigate and adapt to climate change and climate risks has validated Bangladesh's climate finance-backed programs. This study offers substantial insights into Bangladesh's climate-related challenges, which will mitigate the vulnerability of livelihoods to the effects of climate change.

Keywords: Climate Change, Livelihood Vulnerability, Climate Adaptation, Mitigation Strategies, Climate Finance
JEL Classifications: Q54, Q56

1. INTRODUCTION

Bangladesh, one of the most vulnerable nations to climate change, is currently grappling with severe difficulties caused by global warming. Due to recurrent temperature increases, ice melting, and rising sea levels, Bangladesh is experiencing frequent natural calamities such as cyclones, droughts, riverbankerosion, floods, earthquakes, and human life (Alam et al., 2017; Anderson et al., 2017; Uddin et al., 2025). The country faces challenges in terms of limited access to essential financial services, basic healthcare facilities, adequate food and nutrition, and sustainable and economical energy sources (Babu, 2025). Climate change

and global warming harm agricultural production, the natural environment, biodiversity, soil degradation, and soil fertility (Price et al., 2024). Residents of Bangladesh's coastal areas are relocating as a survival strategy. The economic ramifications of climate change in Bangladesh have grown significant. Given its limited resources and huge population, Bangladesh faces significant challenges in combating climate change and global warming. Due to its severely constrained capability, resources, skills, and information, Bangladesh has significant challenges in combating global warming and climate change. Climate change poses a risk to the stability of financial systems by increasing the likelihood of catastrophic weather events and policy changes, which in turn reduce asset value (Bhandary et al., 2021; Tashmin, 2016). Market players are apprehensive about both tangible and transitional climate concerns. Assets may suffer substantial damage due to physical hazards such as storms, wildfires, droughts, hurricanes, sea level rise, deluges, and weather patterns. These shifts result in a higher probability and greater uncertainty of environmental catastrophes due to rising global temperatures (Pointner and Ritzberger-Grünwald, 2019). Typically, an increase or decrease in transition danger correlates with the reappearance of green securities. Investors use organizational data to assess a corporation's vulnerability to climate-related jeopardies, while they rely on sectoral classifications to gauge a company's susceptibility to physical threats. Investors want remuneration for their vulnerability to both types of climate risk (Bua et al., 2024). The transition to a zero-carbon economy and the resulting environmental changes have become major issues for financial investors and regulators. This is primarily due to the financial risks and the potential for systemic impacts. Both the corporeal concerns of climate change and the mechanics of transitioning to a new system may cause a reassessment of the value of financial assets through a variety of direct and indirect mechanisms. Climate-related financial risks may actually have substantial repercussions for the financial system's stability (Demekas and Grippa, 2021; Gutiérrez & Gutiérrez, 2019; World Bank Group, 2020).

Significant research on catastrophes, risk, and climate change has identified three overarching descriptions of the interconnected and ever-changing relationship between social and environmental vulnerability. Exposure to perilous occurrences primarily concerns human populations and societal systems. The second examination examines the social and historical circumstances that expose individuals to a wide array of climate-related, political, or economic pressures. The third factor encompasses the convergence of tangible occurrences, the fundamental causal attributes of populations that result in vulnerability to risk, and the constrained ability of communities to react. Therefore, livelihood susceptibility to climate change stems from both biophysical and social factors. Biophysical climate change vulnerability refers to how vulnerable populations are to sea level increase, atmospheric temperature increase, and sea surface temperature rise. Climate variability makes rural livelihoods more vulnerable and decreases household resilience to risks, shocks, and stressors. These families' few assets put them at risk and limit their ability to cope. Variables that affect a community's sensitivity to injury and response capabilities contribute to social vulnerability. It also includes "place inequalities," which refer to factors such as urbanization, progress rates, and economic vibrancy in communities and physical environments that contribute to social vulnerability in specific regions (Shah et al., 2013).

Climate change exacerbates inequality by disproportionately distributing both the risks and responsibilities associated with it. Adaptation financing aims to eliminate unfairness by providing financial support from wealthy countries that enables vulnerable populations to make critical behavioral changes in direction to decrease climate-related hazards. The allocation and impact of adaptation funds serve as a substitutive measure. Adaptation financing communities strive to address climate-related risks more effectively, enhancing agency and security and promoting sustainable reductions in climate vulnerability. On the other hand, informal practice villages focus less on addressing climate risks and tend to create short-term remedies that do not effectively reduce susceptibility in the long run. Communities that are vulnerable and receive financial support for adaptation change their behaviors to reduce climate-related risks and ensure local justice (Barrett, 2013). Additionally, climate finance can enhance strategies for managing catastrophe risks in Sub-Saharan Africa by supporting funds in entrepreneurship and non-agricultural businesses to mitigate water scarcity issues related to agricultural industries. Additionally, climate finance can support the implementation of regular and comprehensive policy evaluations to enhance policy coherence across different sectors (Chirambo, 2023).

The Cancun decision and the Durban Platform on climate change, which further affirmed the 1991 Copenhagen Accord, committed developed countries worldwide to raising $100 by 2020. The ultimate goal of this funding was to ensure environmental sustainability by supporting reworking and alleviation measures in emerging nations. To address climate change, developed nations have committed to providing climate finance through multilateral climate funds. Many developed and developing countries have used their bilateral development assistance to initiate and direct climate funding. In Bangladesh, there are two climate change trust funds. The Bangladesh government allocates $100 million to support the Bangladesh Climate Change Trust Fund (BCCTF). Many donors, totaling $110 million, support the Bangladesh Climate Change Resilience Fund (BCCRF). The dual approach emerged due to ongoing disagreements over the previous three years between the Government of Bangladesh, NGOs, donors, and the World Bank regarding funding management and financial accountability (Hedger, 2011). In addition, there are two multidonor programs focused on climate change. The World Bank's Pilot Programme for Climate Resilience (PPCR) has awarded $110 million to Bangladesh's Special Programme for Climate Resilience. In 2010, the Comprehensive Disaster Management Programme (CDMP) launched its second phase with $70 million (Hedger, 2011).

An in-depth examination is necessary to understand how climate change and climate-related risks affect individual assets. Additionally, a thorough investigation is required to determine the extent to which Bangladesh has fostered, initiated, and implemented climate finance-backed initiatives for climate change adaptations and mitigation techniques, thereby addressing the

susceptibility of livelihoods due to climate change. Therefore, we also need to answer the following questions:

i. In terms of major asset classification, how does climate change affect individuals' livelihood susceptibility?
ii. How climate change livelihood susceptibility is linked to alleviation and reworking strategies for climate alteration and climate hazards?
iii. What is the association between climate financing efforts and the methods for mitigating and adapting to climate change and climate hazards?
iv. How might the allocation of funds for climate-related initiatives assist in reducing the impact of climate change in Bangladesh, a nation highly susceptible to climate-related challenges?

2. LITERATURE SURVEY AND HYPOTHESES DEVELOPMENT

2.1. Impact of Climate Change on Individual Capital

2.1.1. Climate change and human capital

Caruso et al. (2024) unequivocally showed that climate change significantly impacts critical facets of human development over the whole lifetime. This study differentiates between two paths: one that directly affects human capital related to health, nutrition, and general well-being, and another that leads to the indirect deterioration of infrastructure, markets, and economic systems. Furthermore, mitigation and adaptation efforts entail substantial expenses on human capital for certain industries and societal groups. In 2010, Baez et al. used real-world data to study the economic impact of natural disasters on the development of human capital after the occurrence. The research examined consumption, nutrition, schooling, well-being, and mental health. This work yielded three major findings. At first glance, disasters appear to destroy human resources, including life and property, nourishment, education, health, and many income-generating activities. Additionally, certain negative effects are severe and lifelong. The impacts on different socioeconomic categories vary in degree but not direction. However, numerous natural catastrophes show that the most economically disadvantaged suffer the greatest effects on human capital components and outcomes. Policy action may lessen the effects of environmental risks on human capital accumulation, even when authorities have limited control over them. Consequently, this research puts forward the following hypothesis:

H_1: The frequency of climate change disasters has an impact on individuals' human capital.

2.1.2. Climate change and social sapital

Benevolenza and DeRigne (2019) did research examining the impact of natural catastrophes on the overall well-being and physical health of individuals. Additionally, they analyzed the demographic attributes that render some populations more susceptible to harm. Factors related to the natural catastrophe itself and the absence of effective disaster-response measures heightened and worsened the well-being of disadvantaged communities, both mentally and physically. Furthermore, studies have demonstrated the effectiveness of promoting social capital as a stress-reduction strategy for underprivileged populations. Consequently, the present investigation suggests the following hypothesis:

H_2: The frequency of climate change disasters has an impact on individuals' social capital.

2.1.3. Climate change and financial capital

Fabris (2020) suggests that climate change might adversely affect the financial well-being of financial organizations. Climate change is a financial risk; thus, central banks and regulators must address it to protect financial stability. Supervisors and financial institutions have failed to adequately address this form of risk in recent years. Feyen et al. (2020) examined macrofinancial risks and climate concerns. This study integrates climate-related hazards and macro-financial management and risks research from several fields. Climate change and the transition to a robust low-carbon economy pose major challenges to macro-financial management. These issues might suddenly hurt investment and economic growth, fiscal revenue and expenditure, debt sustainability, and financial asset values, threatening governments, consumers, firms, and financial institutions. Many countries are in "double jeopardy" from macro-financial and climatic challenges, according to the research. For this reason, we are proposing the following hypothesis in our ongoing investigation:

H_3: The frequency of climate change disasters has an impact on individuals' financial capital.

2.1.4. Climate change and physical capital

Kanagaretnam et al. (2022) examined climate risk and company investment in physical and non-physical assets. The study indicated that climate vulnerability mostly affects sectors that are not vulnerable to climate change, which increases the association between climate risk and physical capital. However, susceptible sectors drive the negative link between climate risk and organizational capital. Ciscar et al. (2011) also calculated the economic losses associated with climate change. Ciscar et al. (2011) predict that climate change would affect four market sectors (agriculture, river floods, coastal areas, and tourism) and one nonmarket sector (human health) in Europe. Research shows that if 2080s climate conditions occurred today, family welfare in the EU would decline by 0.2-1% each year owing to four market consequences. Climate change might cut the EU's yearly benefit rise by 50% if welfare losses stay steady. Sea level rise and rising temperatures worsen economic damage. The results show considerable regional differences across Europe. Climate change primarily impacts Southern Europe, the British Isles, and northern Central Europe. Northern Europe relies on agriculture for economic growth. Four elements have major market consequences for coastal systems, agriculture, and river floods. Therefore, our current investigation is based on the following assumptions:

H_4: The frequency of climate change disasters has an impact on individuals' physical capital.

2.1.5. Climate change and natural capital

Bastien-Olvera et al. (2024) studied. Environmental benefits can include tangible goods for purchase and sale, as well as intangible ones that are not economically quantifiable. Globally, climate change will alter ecosystems' spatial distribution and benefits. Bastien-Olvera et al. (2024) examined how climate change affects country-level economic productivity and non-market ecological services. Bastien-Olvera and Moore (2022) found that climate change affects natural systems greatly and perhaps irreversibly. Bastien-Olvera and Moore (2022) cover numerous topics, including natural capital accounting and climate change economics. Therefore, we base our current investigation on the following premises:

H_5: The frequency of climate change disasters has an impact on individuals' natural capital.

2.2. Impact of Climate Change on Livelihood Vulnerability

2.2.1. Climate change's livelihood vulnerability and human capital

Paavola (2008) studied public health, education, and welfare initiatives that aim to improve human capital in response to livelihood, vulnerability, and climate change adaptation. In addition, extensive changes in climatic factors are on the horizon, as shown and suggested by Heltberg et al. (2009). Rainfall and temperature patterns, the occurrence and brutality of severe weather events, agricultural output and pricing, water accessibility and availability, dietary habits, and health outcomes will all undergo changes. Heltberg et al. (2009) predicted that emerging nations, due to their geographical proximity, reliance on climate change-vulnerable industries, low incomes, and limited ability to adapt, would face the most severe consequences. Although not fully understood, socioeconomic consequences will impact humans in various ways, both directly and indirectly. Therefore, our present inquiry is based on the following assumptions.

H_6: Climate change's livelihood vulnerability is impacted by climate change's impacted individuals' human capital.

2.2.2. Climate change's livelihood vulnerability and social capital

In 2001, Adger performed a study that analyzed the assessment of vulnerability, available alternatives for adaptation, and the influence of social capital on the ability to adapt to climate change. Policy and research experts debate and disagree on these topics. When evaluating the future effects of climate change, it is common to use models to measure the dangers, consequences, or persons who may be affected by certain impacts. In addition, the idea of social capital seems to be relevant and applicable in several social science disciplines when addressing the vulnerability of livelihoods in relation to climate change. Social capital refers to the fundamental elements of trust, reciprocity, and trade in relationships, as well as the improvement of collective customs and the significance of networks. The concept assigns a function to the involvement of the general public and collective efforts, driven by both practical and democratic motives. It aims to explain the varying geographical distribution of social interactions. Adger (2010). Hence, our current investigation is based on the following suppositions.

H_7: Climate change's livelihood vulnerability is impacted by climate change's impacted individuals' social capital.

2.2.3. Climate change's livelihood vulnerability and financial capital

The research conducted by Keshavarz et al. (2017) illustrated the interplay of financial, physical, social, and natural capitals in determining the susceptibility of livelihoods. Huong et al. (2019) found that the "Pa Vay Su" community had a higher vulnerability compared to other communities in terms of housing, knowledge and skills, socio-demographics, health and water security, social networks, and livelihood strategy. With the exception of food security, climatic unpredictability, and natural catastrophes, "Hien Luong" was particularly susceptible to LVI issues. The hamlet of "Moc Chau" is more susceptible to risks due to water security and socioeconomic demographics compared to Hien Luong commune. Therefore, our study is based on the following assumptions.

H_8: Climate change's livelihood vulnerability is impacted by climate change's impacted individuals' financial capital.

2.2.4. Climate change's livelihood vulnerability and physical capital

Pandey et al. (2017) assessed climate change vulnerability and adaptation. The researchers examined how individuals saw and responded to climate change and how they addressed it. Pandey et al. (2017) assess climate change vulnerability and response using the Climate Vulnerability Index (CVI) and Current Adaptive Capacity Index (CACI). The five components of human, natural, financial, social, and physical capital that enable sustainable lifestyles are included in CVI and CACI. The findings revealed that families with agricultural development programs (ADH) were more exposed to human and natural capital risks than those without. Dual-earner households (ADH) exhibited lower social capital and financial capital vulnerability than non-dual-earner families (NDH). ADH families were more vulnerable than NDH families. Thus, our current investigation is based on the following presumptions.

H_9: Climate change's livelihood vulnerability is impacted by climate change's impacted individuals' physical capital.

2.2.5. Climate change's livelihood vulnerability and natural capital

Pandey et al. (2017) assessed climate vulnerability and adaptation using the Climate Vulnerability Index (CVI) and the Current Adaptive Capacity Index (CACI). Both CVI and CACI include the five categories of resources that play a role in fostering sustainable livelihoods: human, natural, financial, social, and physical capital. We assessed each kind of capital using the IPCC vulnerability assessment technique, which considers three factors: adaptive capability, sensitivity, and exposure. Consequently, our current work is based on the following concepts.

H_{10}: Climate change's livelihood vulnerability is impacted by climate change's impacted individuals' natural capital.

2.3. Mitigation and Adaptation Strategies and Livelihood Vulnerability

Paavola (2008) demonstrated that ethical governance of natural resources is crucial in adaptation efforts, as they serve as safety nets for disadvantaged people and help minimize susceptibility to climate change impacts on livelihoods. Goklany (2007) devised comprehensive strategies and methods for adaptation, mitigation, and sustainable development. These approaches include several sustainable development projects. This work entails establishing and strengthening institutions, policies, and infrastructure to enhance economic growth, technology, human and social capital, and sustainable development. These strategies also help reduce vulnerability to urgent climate-related challenges that hinder sustainable development and worsen its impacts. Implementing sustainable economic development measures might potentially lead to a decline in birth rates, reducing the population's vulnerability to climate change andrelated hazards. This mitigates the overall consequences of climate change and minimizes the need for adaptation. Therefore, our present study is based on the following points:

H_{11}: Mitigation and adaptation strategies towards climate change and climate hazards can minimize livelihood vulnerability to climate change.

2.4. Mitigation and Adaptation Strategies and Climate Finance-backed Initiatives

Climate financing refers to the process of collecting financial resources to assist impoverished nations in their endeavors to adapt to and mitigate the effects of climate change and global warming (Nakhooda et al., 2015). Digitemie and Ekemezie (2024) examined the crucial role of climate funding in supporting impoverished nations in mitigating and adapting to the impacts of climate change. The evaluation starts by providing a thorough overview of the worldwide climate finance landscape, highlighting significant avenues such as public funding, corporate investments, and inventive financing frameworks. Afterwards, it analyzes the allocation and distribution of climate funds, closely examining the trends, disparities, and challenges in accessing and using financing in impoverished nations. Moreover, the evaluation assesses the effectiveness of climate finance in strengthening efforts to reduce and adapt to climate change in impoverished nations. Furthermore, the evaluation explores innovative approaches to financing, including green bonds, climate insurance, and carbon pricing, as potential means of generating additional resources for climate action in impoverished countries. Developing countries may accomplish their development objectives and transition to low-carbon, climate-resilient economies by using climate funds effectively and efficiently. Scandurra et al. (2020) analyzed the distribution of climate money to these countries at a global level to support their adaptation and mitigation activities, hence reducing their vulnerability. Accordingly, this study is proposing the following hypothesis:

H_{12}: Mitigation and Adaptation Strategies towards Climate Change and Climate Hazards validated the climate finance-backed initiatives in Bangladesh.

Nevertheless, the extent to which climate change impacts individual capital associated with livelihood vulnerability in Bangladesh remains a subject of thorough inquiry. Research has indicated that climate finance-backed initiatives regarding adaptation and mitigation actions to address climate change issues have received minimal attention, both specifically and more generally. Thus, this study has been commenced. Here are the study's objectives:

i. In terms of major asset classification, identify how climate change affects individuals' livelihood vulnerability
ii. Exploring the linkage of livelihood vulnerability to alleviation and reworking strategies for climate alteration and climate vulnerabilities
iii. Exploring the linkage of mitigation and reworking strategies for climate change and climate hazards linked with climate finance initiatives
iv. Analyzing the impact of climate financing on mitigating climate risk in Bangladesh, a nation highly susceptible to the effects of climate change.

3. MATERIALS AND METHODS

3.1. Study Area

The southern region of Bangladesh mostly comprises three divisions: Barishal, Khulna, and Chattagram. We purposefully chose the Barishal, Khulna, and Chattogram divisions for this research because of the frequent occurrence of disasters brought on by nature and climate change. We have collected data through structured interviews from the Barishal, Chattogram, and Khulna divisions, as illustrated in Table 1.

3.2. Primary Data, Questionnaire Development, Research Ethies, and Instrument Development

In this work, we used a cross-sectional survey approach to collect primary data. The researcher utilized a questionnaire survey to gather data from targeted respondents from May 1, 2023, to January 20, 2024. Before developing the final questionnaire (Table 2), the researcher engages in consistent dialogue with representatives of the concerned target respondents. The

Table 1: Detailed profile of respondents

Name of the division	Name of the district	No. of the respondents
Barishal	Barguna	19
	Pirojpur	19
	Bhola	10
	Barishal	29
	Patuakhali	10
	Jhalakhathi	10
Chattgram	Chattgram	30
	Cox's Bazar	30
	Feni	10
	Noakhali	29
Khulna	Khulna	45
	Bagerhat	35
	Satkhira	39
	Jashore	30
	Narail	61
Grant total		406

Source: Survey Data, 2023-2024

questionnaire included a demographic profile of the respondents, a socio-demographic profile, and the respondents' perceptions of the frequency of climate change disasters (FCCD); the impact of climate change and climate hazards on human, social, financial, physical, and natural aspects; the vulnerability of climate-affected livelihoods (CALV); the mitigation and adaptation strategies towards climate change and climate hazards (MSTCCCH); and the requirements for climate finance-backed initiatives (CFBIR). The researcher arranged each question from broad to specific to enhance understanding. The structured questionnaire consisted solely of closed-ended questions. Before administering the questionnaire survey, respondents' verified consent was obtained. A statement was provided to assure that their data would only be used for the study, and anonymity was maintained to uphold research ethics. This study is entirely free of personal bias during the data collection phase and does not involve any modification of data entry, editing, coding, cleaning, or analysis.

A pilot study was conducted to enhance the instruments' and the questionnaire's readability and clarity, and a number (50) of participants provided insightful feedback. To make the instruments better, indeterminate components have been found and changed.

3.3. Sample Size, Sampling Procedure, and Scaling

The formula for determining the sample size when the population size (n) is unknown is as follows:

$$n = \frac{z^2 pq}{e^2} \quad (1)$$

The value of n is obtained using equation number (1) as follows:

$$n = \frac{z^2 pq}{e^2} = \frac{(1.96)^2 (0.5)(0.5)}{(0.05)^2} = 384.16 \approx 385$$

In this study, we have included a reserve sample of 30% in case any of the selected respondents are unavailable or unwilling to participate in the survey. So far, five hundred (500) respondents have been considered for this study. After collecting the data, we identified numerous inconsistencies in the questionnaire survey. After filtering the total, we considered the responses of 406 respondents for testing the hypotheses. We selected the respondents using non-probability convenience sampling because it is simple and convenient for data collection, and we emphasized experience, related knowledge, and skills throughout the questionnaire survey. This study used a five-point Likert scale, where a rating of 5 denoted strong agreements, 4 denoted agreement, 3 denoted neutrality, 2 denoted disagreement, and 1 denoted significant disagreement.

3.4. PLS-SEM Aproaches

PLS-SEM was used to estimate the measurement and structural model. PLS-SEM is renowned for its remarkable adaptability to a wide range of modeling challenges, including complicated models and formative components. Additionally, it works well with datasets that have tiny sample sizes. Owing to these beneficial characteristics, PLS-SEM has become widely used and popular in a variety of research fields, such as business, social science, information management, accounting and finance, and environmental management (Hair et al., 2017; Gotz et al., 2010;

Table 2: Details of instrument

Construct	Frequency of climate change disasters (FCCD)
FCCD1	Severity of Drought
FCCD2	Availability of Ground and Surface Water
FCCD3	Severity of Riverbank Erosion
FCCD4	Frequency of Flood, Cyclone, and
Construct	**Impact of Climate Change and Climate Hazards on Human Capital (ICCCH_HC)**
ICCCH_HC1	Food Safety and Nutrition
ICCCH_HC2	Unemployment
ICCCH_HC3	Disease and Health Condition
ICCCH_HC4	Migration
Construct	**Impact of Climate Change and Climate Hazards on Social Capital (ICCCH_SC)**
ICCCH_SC1	Educational Institutions
ICCCH_SC2	Religious Institutions
ICCCH_SC3	Medical Facilities and Infrastructure
ICCCH_SC4	Farmers to Farmers Co-operation
ICCCH_SC5	Organizational Engagement
Construct	**Impact of Climate Change and Climate Hazards on Financial Capital (ICCCH_FC)**
ICCCH_FC1	Credit Facilities
ICCCH_FC2	Market Access
ICCCH_FC3	Income from Agriculture
ICCCH_FC4	Savings
Construct	**Impact of Climate Change and Climate Hazards on Physical Capital (ICCCH_PC)**
ICCCH_PC1	Household property and Embankment
ICCCH_PC2	Sanitation Facilities
ICCCH_PC3	Transportation Facilities and Marketplace
ICCCH_PC4	Electricity
Construct	**Impact of Climate Change and Climate Hazards on Natural Capital (ICCCH_NC)**
ICCCH_NC1	Land Availability and Soil Fertility
ICCCH_NC2	Drinking Water Availability
ICCCH_NC3	Livestock and Fisheries
ICCCH_NC4	Forestry
Construct	**Climate Affected Livelihood Vulnerability (CALV)**
CALV1	Regular Income Vulnerability
CALV2	Household Displacement
CALV3	Occupational Migration
CALV4	Health Disease and Health Vulnerability
CALV5	Agricultural unproductivity
Construct	**Mitigation and Adaptation Strategies towards Climate Change and Climate Hazards (MSTCCCH)**
MSTCCCH1	Zero Carbon Emission Footprint Initiatives (awareness, modules and policy)
MSTCCCH2	Natural Disasters Management Initiatives (policies, modules, and coordination)
MSTCCCH3	Reduction of Pollution (air, water, soil, sound, odor pollution)
MSTCCCH4	Rain Water Harvesting (guidelines, training, and development)
MSTCCCH5	Soil Infertility and Sustainable Production and Consumption (loans, guidelines, and training) Degradation (initiatives, guidelines, training)
Construct	**Climate Finance Backed Initiatives Requirements (CFBIR)**
CFBIR1	Climate Resilience Capacity Building (policies, options, training, and development)
CFBIR2	Environmental Conservatism Initiatives (guidelines, outlook, in-house management), Waste Management Initiatives (waste management, wastewater treatment), and Uses of Organic Fertilizers and Chemicals (avoiding chemicals, compost fertilizer).
CFBIR3	Efficient Use of Energy (guidelines, evaluation, and monitoring), Uses of Renewal Energy (biogas), and Recycling Initiatives (plastic, bottles, glass, zar)

Source: Developed by researchers based on existing literatures

Deb et al., 2022; Sarstedt et al., 2022). We found that PLS-SEM was the best method for our study, which aims to understand how climate change and weather-related risks impact the classification of important assets and the vulnerability of people's livelihoods, along with the complicated relationships between different factors. We specifically made use of Smart PLS 4.1.0.0.

4. RESULTS ANALYSIS AND DISCUSSION

4.1. Empirical Results (Respondent's Demographic Profile)

Table 3 displays the demographic distribution of the participants based on their gender, age, educational qualification, and profession. The male population accounts for 74.40% of the total, and the female population accounts for 29.10%. 0.5% of the population identify with genders other than male or female. Furthermore, the bulk of respondents, encompassing 31.8% of the total, fall between the age range of 41-50. Furthermore, just 21.9% of individuals possess SSC qualifications, while 19.5% have achieved academic honors. Furthermore, a significant majority of individuals, accounting for 26.8%, lack the ability to read and write, whereas 14.5% possess Higher Secondary Certificate qualifications. Furthermore, the participants include a range of occupations, including service (7.4%), business (16%), farming (34%), homemaking (21.2%), and other professions (21.4%).

4.2. Measurement Model

The assessment of the reflective measurement model examines how well the indicators relate to each other and to the overall concept, as well as their reliability (Hanafiah, 2020; Sarstedt et al., 2022). Squaring the outer loadings of reflective constructs helps us see how dependable the indicators are, showing how strongly the hidden variable is linked to its visible indicators. Squaring the outer loadings of reflective constructs shows how reliable the indicators are, helping us understand how closely the hidden variable is connected to its visible indicators (Hair et al., 2019). All of the reflective structures' outer loadings, as shown in Table 4, are above the recommended level of 0.700 (Hair et al., 2017), which shows that the indicators are reliable. All indicators' high outer loadings show a strong correlation with the corresponding latent components, indicating sufficient measurement reliability. Cronbach's alpha (CA) and composite reliability (CR) are two different measures used to evaluate how reliable the measurement model is (Hair et al., 2017; Kaya et al., 2020; Nunnally & Bernstein, 1994). The results, shown in Table 4, indicate excellent measurement reliability, as both measures are above the recommended level of 0.7 (Hair et al., 2019). The high values of Cronbach's alpha (CA) and composite reliability (CR) confirm that the measurement model is consistent and reliable in accurately capturing the underlying factors. Excellent measurement reliability is shown by the findings, which are displayed in Table 4, showing that both measures are above the suggested cutoff of 0.7 (Hair et al., 2019). The high scores of Cronbach's alpha (CA) and composite reliability (CR) confirm that the measuring model is consistent and reliable in accurately capturing the underlying factors. The average variance extracted (AVE) was also used to check the measurements' agreement, which is vital for ensuring their validity. The model's strong convergent validity is shown by the data in Table 3, which show that the AVE is above the intended threshold of 0.5 (Hair et al., 2019).

Table 3: Respondent's demographic profile

Details	Frequency	Percent
Gender		
Male	286	70.4
Female	118	29.1
Others	2	0.5
Age		
Below 18	2	0.5
19-30	93	22.9
31-40	109	26.8
41-50	129	31.8
51-60	58	14.3
Above 60	15	3.7
Educational qualification		
Honors	79	19.5
HSC	59	14.5
SSC	89	21.9
Illiterate	109	26.8
Others	70	17.2
Profession		
Service	30	7.4
Business	65	16.0
Agriculture	138	34.0
Housewife	86	21.2
Others	87	21.4

Source: Survey Data, 2023-2024

Several rigorous criteria, such as the Fornell-Larcker criterion (Fornell and Larcker, 1981), the heterotrait-monotrait (HTMT) ratio of the correlations, and the cross-loadings criterion, were used to evaluate discriminant validity, a crucial component of construct validity. These thorough assessments determine the degree to which one concept differs from the others in an empirical manner.

The Fornell-Larcker criterion is a widely used technique for evaluating the discriminant validity of a measurement model. According to these criteria, a concept is considered legitimate only if the square root of its average variance is greater than the correlation between all other constructs (Fornell and Larcker, 1981). The prominent diagonal number in Table 5 verifies and validates the distinctiveness of the measurement models.

We used the HTMT (Heterotrait-Monotrait ratio of the correlations) to evaluate the discriminant validity. According to the HTMT criteria, the HTMT ratio must be substantially below the cutoff points of 0.90 or 0.85 (Hair et al., 2019). All of these discriminant validity requirements have been met, as shown in Table 6, confirming the uniqueness and autonomy of each concept. Strong proof that the constructs are successfully capturing different and distinctive features of the underlying theoretical constructs is provided by this thorough validation of discriminant validity, which also enhances the legitimacy of our measurement paradigm.

4.3. Structural Model

According to Hair et al. (2019) and Sarstedt et al. (2022), when checking the structural model, it's important to look at key factors like the coefficient of determination (R^2) and how significant

Table 4: Results for reflective measurement models

Variables	Item	Convergent validity		Internal consistency reliability	
		Loading >0.70	AVE >0.50	Cronbach's alpha>0.60	CR >0.60
Frequency of climate change disasters (FCCD)	FCCD1	0.917	0.799	0.935	0.952
	FCCD2	0.966			
	FCCD3	0.780			
	FCCD4	0.974			
	FCCD5	0.815			
Impact of climate change and climate hazards on human capital (ICCCH_HC)	ICCCH_HC1	0.918	0.739	0.880	0.918
	ICCCH_HC2	0.921			
	ICCCH_HC3	0.825			
	ICCCH_HC4	0.766			
Impact of climate change and climate hazards on social capital (ICCCH_SC)	ICCCH_SC1	0.900	0.727	0.909	0.930
	ICCCH_SC2	0.894			
	ICCCH_SC3	0.841			
	ICCCH_SC4	0.799			
	ICCCH_SC5	0.823			
Impact of climate change and climate hazards on financial capital (ICCCH_FC)	ICCCH_FC1	0.769	0.615	0.790	0.864
	ICCCH_FC2	0.707			
	ICCCH_FC3	0.799			
	ICCCH_FC4	0.855			
Impact of climate change and climate hazards on physical capital (ICCCH_PC)	ICCCH_PC1	0.792	0.754	0.889	0.924
	ICCCH_PC2	0.799			
	ICCCH_PC3	0.938			
	ICCCH_PC4	0.931			
Impact of climate change and climate hazards on natural capital (ICCCH_NC)	ICCCH_NC1	0.988	0.942	0.979	0.985
	ICCCH_NC2	0.987			
	ICCCH_NC3	0.968			
	ICCCH_NC4	0.939			
Climate affected livelihood vulnerability (CALV)	CALV1	0.968	0.897	0.971	0.978
	CALV2	0.959			
	CALV3	0.971			
	CALV4	0.938			
	CALV5	0.898			
Mitigation and adaptation strategies towards climate change and climate hazards (MSTCCCH)	MSTCCCH1	0.893	0.838	0.953	0.963
	MSTCCCH2	0.949			
	MSTCCCH3	0.955			
	MSTCCCH4	0.886			
	MSTCCCH5	0.891			
Climate finance backed initiatives requirements (CFBIR)	CFBIR1	0.872	0.712	0.797	0.881
	CFBIR2	0.796			
	CFBIR3	0.861			

Source: Reliability and validity tests by using Smart PLS 4.1.0.0

Table 5: Discriminant validity – Fornel-Larcker criterion

Variables	CALV	CFBIR	FCCD	ICCCH_FC	ICCCH_HC	ICCCH_NC	ICCCH_PC	ICCCH_SC	MSTCCCH
CALV	**0.947**								
CFBIR	0.105	**0.844**							
FCCD	−0.023	0.03	**0.894**						
ICCCH_FC	−0.022	0.023	0.287	**0.784**					
ICCCH_HC	0.107	0.096	0.261	0.311	**0.860**				
ICCCH_NC	0.293	−0.055	0.26	0.408	0.083	**0.970**			
ICCCH_PC	0.018	0.023	0.367	0.528	0.257	0.363	**0.868**		
ICCCH_SC	0.16	0.014	0.234	0.499	0.297	0.266	0.664	**0.853**	
MSTCCCH	0.273	0.429	0.267	0.338	0.07	0.555	0.267	0.112	**0.915**

Bold diagonal numbers are the square roots of AVE
Source: Discriminant validity test by using Smart PLS 4.1.0.0

the path coefficients are. Hair et al. (2019) carefully investigate multicollinearity using the variance inflation factor (VIF) before the evaluation. Table 7 illustrates this point by showing that all VIF values stay between 1.000 and 2.057, which is far lower than the crucial number of 3. This finding strengthens the validity of our study by confirming that multicollinearity problems do not exist.

The last results of the structural model evaluation are displayed in Figure 1, which provides key details about the standardized path

Figure 1: Model resolution by SmartPLS using PLS algorithm

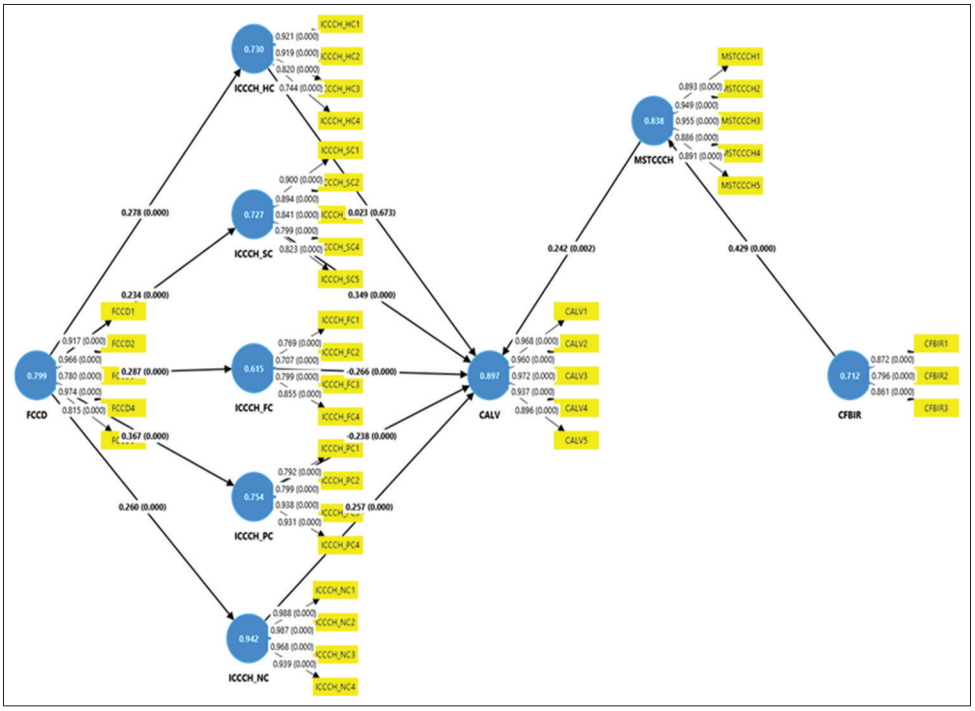


Table 6: Discriminant validity: Heterotrait-Monotrait ratio (HTMT) matrix

Variables	CALV	CFBIR	FCCD	ICCCH_FC	ICCCH_HC	ICCCH_NC	ICCCH_PC	ICCCH_SC	MSTCCCH
CALV									
CFBIR	0.147								
FCCD	0.053	0.109							
ICCCH_FC	0.066	0.095	0.327						
ICCCH_HC	0.116	0.116	0.286	0.377					
ICCCH_NC	0.294	0.076	0.275	0.464	0.091				
ICCCH_PC	0.06	0.078	0.398	0.631	0.286	0.394			
ICCCH_SC	0.167	0.087	0.234	0.582	0.318	0.282	0.394		
MSTCCCH	0.278	0.457	0.283	0.404	0.073	0.602	0.282	0.115	

Source: Discriminant validity test by using Smart PLS 4.1.0.0

Table 7: Variance inflation factors (VIF)

Path	Value
CFBIR -> MSTCCCH	1.000
FCCD -> ICCCH_FC	1.000
FCCD -> ICCCH_HC	1.000
FCCD -> ICCCH_NC	1.000
FCCD -> ICCCH_PC	1.000
FCCD -> ICCCH_SC	1.000
ICCCH_FC -> CALV	1.685
ICCCH_HC -> CALV	1.148
ICCCH_NC -> CALV	1.620
ICCCH_PC -> CALV	2.057
ICCCH_SC -> CALV	1.975

Source: Collinearity Statisties by using Smart PLS 4.1.0.0

coefficients (β) found in Tables 8 and 9, along with the explained variance of the endogenous variables (R^2).

Source: R-square and R-square adjusted by using Smart PLS 4.1.0.0

R-squared is a critical statistic in PLS-SEM analysis that measures the model's explanatory ability by expressing the variance explained in

Table 8: Value of R-square and R-square adjusted

Variables	R-square	R-square adjusted
CALV	0.412	0.40
ICCCH_FC	0.520	0.50
ICCCH_HC	0.680	0.66
ICCCH_NC	0.670	0.65
ICCCH_PC	0.350	0.33
ICCCH_SC	0.550	0.53
MSTCCCH	0.480	0.46

Source: R-square and R-square adjusted by using Smart PLS 4.1.0.0

each endogenous component (Hair et al., 2019). In our research, R^2 measures how well our suggested model accounts for the variability in the important components, even though it is often used to evaluate the goodness-of-fit in regression analysis (Sarstedt et al., 2022). Table 8 demonstrates that we have adequately indicated all the values.

The frequency of climate change disasters (FCCD) significantly impacts the impact of climate change and climate hazards on human capital (ICCCH_HC) ($\beta = 0.261$, $P < 0.000$), according to Table 9's PLS analysis. This data supports the hypothesis (H_1) that FCCD has a substantial impact on the ICCCH_HC.

Table 9: Summary of the results

Path	Estimates (β)	Standard deviation	T statistics	P-values	Results
FCCD -> ICCCH_HC	0.261	0.049	5.323	0.000	H_1 Supported and Accepted
FCCD -> ICCCH_SC	0.234	0.051	4.558	0.000	H_2 Supported and Accepted
FCCD -> ICCCH_FC	0.287	0.044	6.49	0.000	H_3 Supported and Accepted
FCCD -> ICCCH_PC	0.367	0.051	7.144	0.000	H_4 Supported and Accepted
FCCD -> ICCCH_NC	0.260	0.049	5.287	0.000	H_5 Supported and Accepted
ICCCH_HC -> CALV	0.121	0.051	2.39	0.017	H_6 Supported and Accepted
ICCCH_SC -> CALV	0.330	0.067	4.924	0.000	H_7 Supported and Accepted
ICCCH_FC -> CALV	−0.287	0.061	4.693	0.000	H_8 Supported and Accepted
ICCCH_PC -> CALV	−0.242	0.063	3.867	0.000	H_9 Supported and Accepted
ICCCH_NC -> CALV	0.266	0.069	3.838	0.000	H_{10} Supported and Accepted
MSTCCCH -> CALV	0.242	0.079	3.043	0.002	H_{11} Supported and Accepted
CFBIR -> MSTCCCH	0.429	0.052	8.183	0.000	H_{12} Supported and Accepted

Source: PLS algorithm and Bootstrapping test by using Smart PLS 4.1.0.0

Similarly, Impact of Climate Change and Climate Hazards on Social Capital (ICCCH_SC) is positively impacted by the frequency of climate change disasters (FCCD) in a statistically significant way (β = 0.234, P < 0.000). The outcome confirms the hypothesis (H_2) that FCCD has a positive impact on ICCCH_SC.

Additionally, there is a statistically significant positive correlation between the frequency of climate change disasters (FCCD) and the impact of climate change and climate hazards on financial capital (ICCCH_FC) (β = 0.287, P < 0.000). The outcome is consistent with hypothesis (H_3), which states that FCCD raises ICCCH_FC levels.

Furthermore, there is a statistically significant positive connection (β = 0.367, P < 0.000) between the Impact of Climate Change and Climate Hazards on Physical Capital (ICCCH_PC) and the frequency of climate change disasters (FCCD). The result supports hypothesis (H_4), according to which FCCD increases ICCCH_PC levels.

Additionally, a statistically significant positive correlation (β = 0.260, P < 0.000) exists between the Impact of Climate Change and Climate Hazards on Natural Capital (ICCCH_NC) and the frequency of climate change disasters (FCCD). The findings corroborate hypothesis (H_5), which posits that FCCD elevates ICCCH_NC levels.

In addition, a statistically significant positive connection (β = 0.121, P < 0.017) appears between the Impact of Climate Change and Climate Hazards on Human Capital (ICCCH_HC) and Climate Affected Livelihood Vulnerability (CALV). The results support hypothesis (H_6), which asserts that ICCCH_HC increases CALV levels.

Moreover, a statistically significant positive correlation (β = 0.330, P < 0.000) exists between the Impact of Climate Change and Climate Hazards on Social Capital (ICCCH_SC) and Climate Affected Livelihood Vulnerability (CALV). The findings corroborate hypothesis (H_7), which posits that ICCCH_SC elevates CALV levels.

In addition, a statistically significant positive correlation (β = −0.287, P < 0.000) exists between Climate Affected Livelihood Vulnerability (CALV) and the Impact of Climate Change and Climate Hazards on Financial Capital (ICCCH_FC). The results support hypothesis (H_8), which asserts that ICCCH_FC increases CALV levels.

Likewise, there is a statistically significant positive correlation (β = −0.242, P < 0.000) between Climate Affected Livelihood Vulnerability (CALV) and the Impact of Climate Change and Climate Hazards on Physical Capital (ICCCH_PC). The results corroborate hypothesis (H_9), which posits that ICCCH_PC elevates CALV levels.

Similarly, there is a statistically significant positive correlation (β = 0.266, P < 0.000) between the Impact of Climate Change and Climate Hazards on Natural Capital (ICCCH_NC) and Climate Affected Livelihood Vulnerability (CALV). The results support Hypothesis (H_{10}), suggesting that ICCCH_NC elevates CALV levels.

In the same vein, there is a statistically significant positive correlation (β = 0.242, P < 0.000) between Climate Affected Livelihood Vulnerability (CALV) and Mitigation and Adaptation Strategies for Climate Change and Climate Hazards (MSTCCCH). The results are consistent with Hypothesis (H_{11}), which posits that MSTCCCH enhances the minimization of CALV levels.

Finally, there is a statistically significant positive association (β = 0.429, P < 0.000) between Mitigation and Adaptation Strategies for Climate Change and Climate Hazards (MSTCCCH) and Climate Finance Backed Initiatives Requirements (CFBIR). The findings support Hypothesis (H_{12}), which states that CFBIR raises MSTCCCH levels.

5. DISCUSSION

The study's findings revealed that climate change disasters have an effect on several aspects of human society, including individual human capital, social capital, financial capital, physical capital, and natural capital, as hypothesized in hypotheses 1, 2, 3, 4, and 5.

The study's findings verified hypothesis 1 and showed that the frequency of climate change catastrophes affects people's human capital. Individual food safety, nutrition, unemployment, diseases, health conditions, and migration may all be negatively impacted by the frequency of climate change disasters, such as the severity of

drought, the availability of ground and surface water, the severity of riverbank erosion, the large number of floods, and cyclones. This investigation's results were consistent with research projects conducted by Baez et al. (2010) and Caruso et al. (2024).

The study's results verified hypothesis 2 and showed that the frequency of climate change catastrophes affects people's social capital. The frequency of climate change disasters, such as severe drought, surface and groundwater availability, riverbank erosion, massive floods, and cyclones, can have detrimental effects that include destroying and damaging infrastructure, medical facilities, educational institutions, and religious institutions and limiting farmer-to-farmer cooperation and organizational engagement. The results of this investigation aligned with the research carried out by Benevolenza and DeRigne (2019).

The study's results verified hypothesis 3 and showed that the frequency of climate change catastrophes affects people's financial capital. The frequency of climate change-related disasters, such as severe droughts, ground and surface water availability issues, riverbank erosion, floods, and cyclones, can have detrimental effects on credit facilities, market access, agricultural income, and savings. This study's results were in line with those of research by Feyen et al. (2020) and Fabris (2020).

The study's findings verified hypothesis 4 and showed that the frequency of climate change catastrophes affects people's physical capital. The frequency of climate change disasters, including severe droughts, surface and groundwater availability issues, riverbank erosion, floods, and cyclones, can have detrimental effects on household property, embankments, transportation infrastructure, sanitary facilities, marketplaces, and electricity supply. The results of this investigation aligned with the conclusions of research by Ciscar et al. (2011) and Kanagaretnam et al. (2022).

The study's findings verified hypothesis 5 and showed that the frequency of climate change catastrophes affects people's natural capital. Land availability, soil fertility, drinking water availability, livestock and fisheries, and forests can all be negatively impacted by the frequency of climate change disasters, such as severe droughts, ground and surface water availability, severe riverbank erosion, massive floods, and cyclones. The results of the investigation supported the findings of studies by Bastien-Olvera and Moore (2022) and Bastien-Olvera et al. (2024).

In addition, hypotheses 6, 7, 8, 9, and 10 propose that the vulnerability of people' livelihoods to climate change is greatly affected by their social, human, economical, physical, and natural capital.

Furthermore, hypothesis 6 states that human beings' susceptibility to climate change has a significant impact on their livelihoods. In terms of human capital, climate change and climate hazards negatively affect people's ability to eat healthily and safely, lead to increased unemployment, contribute to the spread of disease, adversely impact health, and drive migration. The results of this investigation aligned with the research carried out by Paavola (2008) and Heltberg et al. (2009).

The results of the research indicate that the social capital of those affected by climate change influences livelihood vulnerability, which is corroborated by hypothesis 7. By damaging educational institutions, religious institutions, medical facilities, and infrastructure; lessening farmer-to-farmer cooperation; and organizational engagement, climate change and its hazards can harm people's social capital. The findings of this study were consistent with those of Adger's (2001) and Adger's (1999) studies.

The study's conclusions validated hypothesis (8) and showed that people's financial capital is affected by climate change, which in turn affects livelihood vulnerability. Reduced credit facilities, market access, agricultural income, and savings are just a few of the ways that climate change and its hazards may negatively affect people's financial resources. The findings of this study were consistent with those of studies conducted by Keshavarz et al. (2017) and Huong et al. (2019).

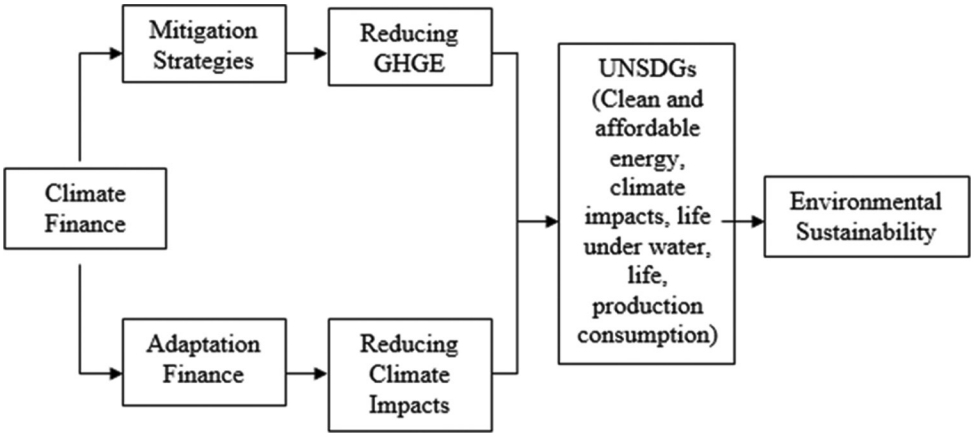
The research results suggest that the physical capital of affected individuals influences the susceptibility of livelihoods to climate change, thereby supporting hypothesis 9. Climate change and associated hazards may adversely affect household property, embankments, sanitation facilities, transportation infrastructure, electricity, and marketplaces; hence, they may exacerbate livelihood vulnerability. The results of this research aligned with those of Pandey et al. (2017) and Kanagaretnam et al. (2022).

The research results suggest that the natural capital of affected individuals influences the susceptibility of livelihoods to climate change, thereby supporting hypothesis 10. Climatic change and climatic hazards may adversely affect land availability, degrade soil fertility, diminish drinking water availability, negatively influence livestock and fisheries, and reduce forestry resources, hence increasing livelihood vulnerability due to climate change. The results of this study aligned with those of research by Pandey et al. (2017) and Bastien-Olvera and Moore (2022).

Similarly, our study has also shown that the use of techniques to limit the impact of climate change and climate-related risks may decrease the susceptibility of livelihoods to climate change, as described in Hypothesis 11. Climate-affected livelihood vulnerability positively correlates with mitigation and adaptation strategies for climate change and climate hazards in a statistically meaningful way. The results are consistent with Hypothesis (H11). By implementing initiatives to manage natural disasters, reduce air, water, soil, sound, and odor pollution, harvest rainwater, reduce soil infertility and enable sustainable production, and reduce consumption, it is possible to ensure mitigation and adaptation strategies for climate change and climate hazards, which will lessen the vulnerability of livelihoods affected by climate change. The study's findings are consistent with those of Paavola (2008) and Goklany (2007).

Based on our survey findings, the current mitigation and adaptation efforts in Bangladesh are inadequate. Hypothesis 12 confirms the effectiveness of Bangladesh's climate finance-backed programs in implementing adaptation and mitigation solutions for climate

Figure 2: Climate finance towards achieving SDGs



change and climate risks. This study validated the implementation of climate finance-supported initiatives for both mitigation and adaptation strategies aimed at addressing climate change and related hazards. These initiatives include building climate resilience, establishing environmental conservatism guidelines, managing in-house operations, handling waste management, treating wastewater, utilizing organic fertilizers and chemicals, avoiding harmful substances, composting, promoting efficient energy consumption, applying renewable energy solutions (such as biogas), and implementing recycling programs for plastics, bottles, glass, and zar. The findings of this study were consistent with those of the studies conducted by Digitemie and Ekemezie (2024) and Scandurra et al. (2020).

Climate financing is crucial in reducing climate risk. The primary differentiating feature of the 406 survey answers we obtained was the notable consistency of opinion on several important topics. The widespread agreement in replies highlights the importance of climate financing in mitigating climate risk. Furthermore, our study revealed that the existing measures pertaining to the use of climate money were inadequate and posed greater risks in terms of climate finance-supported initiatives.

6. CONCLUSION

Bangladesh is often regarded as very vulnerable among all the countries affected by climate change. The development trajectory of Bangladesh is significantly impeded by climate change-induced natural disasters, including cyclones, floods, droughts, saline intrusion, increasing sea levels, and heightened soil salinity. The phenomenon of climate change and the resulting vulnerabilities it creates may pose a significant threat to individuals' livelihoods. Tackling the consequences of climate change is a substantial obstacle in attaining sustainable and fair development. Bangladesh fully dedicates itself to mitigating the vulnerabilities and numerous hazards resulting from global climate change. Nevertheless, there is a lack of comprehensive research on the precise effect of climate change and climatic hazards on people' capital and how these elements contribute to vulnerability in their livelihoods. Simultaneously, the use of climate financing by Bangladesh in this particular situation has garnered less scrutiny. Hence, the objective of this study was to assess the repercussions of a climate change catastrophe on different categories of assets, as well as its effect on people's livelihood susceptibility. Analyze the impact of climate financing on mitigating climate risk in Bangladesh, a nation susceptible to the effects of climate change. The study's findings suggest that climate change catastrophes have a significant influence on several dimensions of individual capital, including individual human capital, social capital, financial capital, physical capital, and natural capital. Furthermore, this kind of climate-impacted capital significantly impacts the vulnerability of individuals' livelihoods to climate change. Our work has also shown that the use of mitigation and adaptation strategies for climate change and climate hazards may reduce the vulnerability of livelihoods to the effects of climate change. Presently, the measures taken to reduce and cope with the effects of climate change in Bangladesh are insufficient. Utilizing climate finance-supported adaptation and mitigation strategies may effectively address the vulnerability of livelihoods in Bangladesh resulting from climate change and climate hazards.

6.1. Novelty and Contribution of the Study

i. Primarily, this investigation will contribute to the current body of research by illustrating the influence of climate change and climate hazards on the classification of individual capital and the manner in which this capital affects the vulnerability of individual livelihoods.
ii. This emphasizes the necessity of improving the coordination of policies supported by climate funding and increasing the mobilization of investments to quickly implement measures that address climate change and enhance the capacity of vulnerable areas to withstand its impacts.
iii. This study, from a coastal state perspective, investigated how climate change and climate hazards impact individual capital and create climate vulnerability. Additionally, it broadened our understanding of basic aspects of individual capital.
iv. This study showed that the coastal developing nations, such as Bangladesh, may achieve climate resilience and advance their development goals by effectively and efficiently using climate funding.
v. This study demonstrated that implementing mitigation and adaptation strategies for climate change and climate hazards in Bangladesh's coastal zones (Barishal, Chattagram, and Khulna) is insufficient and validated the need for climate

finance-backed initiatives.

vi. This research demonstrated that livelihood vulnerability arises from a combination of several factors, including human, social, financial, physical, and natural resources. These forms of capital have intrinsic features that contribute to livelihood risk. This would undoubtedly enhance the comprehension of livelihood risk from the standpoint of capital categorization.

vii. Figure 2 illustrates the actual impact of climate finance on mitigating and adaptive strategies towards achieving SDGs as per our survey results.

7. COMPETING INTERESTS

No conflicts of interest.

8. STUDIES IN HUMAN

This research does not involve the use of any human or animal subjects for biological experimentation or the infringement of privacy.

9. FUNDING STATEMENT

This research work has been funded by University Grants Commission (UGC), Bangladesh

10. DATA AVAILABILITY

Data will be available upon reasonable request.

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