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## Sustainable embankment contribute to a sustainable economy: The impact of climate change on the economic disaster in coastal area

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## ABSTRACT

**Purpose:** The purpose of this study is to examine the relationships between climate change, economic disasters, disaster management, and sustainability in the coastal areas of Bangladesh. Specifically, it aims to investigate how disaster management mediates the impact of economic disasters on sustainable embankment and economic sustainability, providing insights for enhancing resilience in these vulnerable regions.

**Method:** This study employs a quantitative research approach to analyze the relationships among climate change, economic disasters, disaster management, and sustainability in coastal areas of Bangladesh. Data collected through structured surveys administered to key stakeholders in the region, including local residents, government officials, and disaster management experts. To analyze the data, Structural Equation Modeling (SEM) was used.

**Findings:** The results show that climate change has a positive ( $\beta = 0.277$ ) and statistically ( $p$  value  $< 0.05$ ) significant impact on economic disasters in coastal areas, and disaster management is also significantly ( $\beta = 0.172$ ,  $p$  value  $< 0.05$ ) related to mitigating economic disasters. Furthermore, the result demonstrates that disaster management has a positive impact on sustainable embankment ( $\beta = 0.145$ ) and sustainable economy ( $\beta = 0.150$ ) development. Moreover, the

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authors also find that disaster management significantly ( $p$  value  $< 0.05$ ) mediates the relationship between economic disaster and sustainable embankment and economy development. These findings highlight the necessity for policymakers to give integrated disaster response plans and resilient infrastructure funding top priority in order to improve coastal regions' sustainability and economic stability.

*Originality value:* This study contributes to the existing body of knowledge by highlighting the direct relationship between embankment resilience and sustainable economic growth and how both can assist lessen the ongoing impacts of climate change. Moreover, this relationship offers the groundwork for policy interventions specific to Bangladesh's coastal regions by highlighting the significance of infrastructure resilience in mitigating economic disasters.

## 1. Introduction

Transition zones where land meets the sea are known as coastal regions. These areas have a high population density and are hubs of economic activity in developed countries (Sultana et al., 2024). Coastal zones have unique features such as tides, coral reefs, barrier islands, sea shores, and storm waves (Rahman et al., 2022). The coastal zones of Bangladesh cover an area of approximately 47,203 km<sup>2</sup>, encompassing 19 coastal districts and a coastline that stretches for 710 km or 200 nautical miles of Exclusive Economic Zone (EEZ). Bangladesh is one of the world's most climate-vulnerable countries, with a significant percentage of its people living in low-lying coastal areas (Kais and Islam, 2023). The Bangladesh Bureau of Statistics (2022) reports that the coastal regions of Bangladesh are home to more than 43.8 million people. These individuals are confronted with the constant threat of natural disasters, the impact of climate change, and limited socio-economic development (Shampa et al., 2023; Neumann et al., 2015). Climate change is currently and will continue to be the most significant environmental concern in numerous regions of the planet (Kais and Islam, 2023). Due to the extended duration of CO<sub>2</sub> and other greenhouse gases in the atmosphere, as well as the slow response of the oceans to changes in temperature, the ongoing pattern of climate change will persist for centuries, irrespective of any decrease in greenhouse gas emissions (Tol, 2024; Xiong et al., 2024). Nevertheless, the coastal region of Bangladesh is currently grappling with a range of environmental challenges and human-induced risks (Haque and Nahar, 2023). The areas are confronting significant challenges as a consequence of the adverse effects of climate change. Due to its unique geographic location, Bangladesh is highly susceptible to the impacts of climate change and experiences numerous extreme events each year, including tropical cyclones, tidal surges, storm surges, floods, sea level rises, saltwater intrusions, harmful wave actions, erosions, and more (Shampa et al., 2023; Haque and Nahar, 2023).

Rising sea levels, more frequent and influential cyclones, and embankment erosion have enhanced the vulnerability of these areas (Rahman et al., 2022; Wei et al., 2023). The economic collapse of Bangladesh's coastal regions has serious repercussions for the country's long-term growth. It has far-reaching implications, including the loss of valuable agricultural fields, a drop in fishing resources, and infrastructure destruction (Deb et al., 2024). These factors have severe repercussions on the local economy, leading to increased poverty, unemployment, and food insecurity. Additionally, the displacement of community's further burdens urban areas, straining their resources and exacerbating social inequalities (Akter et al., 2024).

In response to these challenges, disaster management has become a critical focus for the government and international organizations working in Bangladesh (Azad et al., 2019). Effective disaster management strategies not only aim to mitigate the immediate impacts of economic disasters but also play a crucial role in fostering long-term sustainability (Rehman et al., 2019). This includes the development of sustainable embankment, which are vital for protecting coastal areas from future disasters and ensuring the stability of local economies (Qi et al., 2023; Wei et al., 2022).

The interconnections between climate change, economic disasters, disaster management, and sustainability are complex and multifaceted. As Bangladesh continues to grapple with these issues, understanding these relationships is essential for developing comprehensive strategies that promote resilience and sustainability in coastal areas. This study aims to explore these dynamics, focusing on the role of disaster management as a mediator in enhancing both sustainable embankment and economic sustainability in the face of climate-induced economic disasters.

Although an abundance of study has been done on how climate change affects coastal economies, little is known about how disaster management is linked with long-term economic sustainability. Current study frequently focuses on certain facets of disaster management or looks at the direct economic effects of climate-related disasters. Moreover, there is a notable gap in understanding how effective disaster management can mediate the relationship between economic disasters and sustainable outcomes, such as sustainable embankments and economies, in the context of Bangladesh's coastal areas. This study seeks to fill these gaps by exploring these complex relationships and providing insights into how integrated disaster management strategies can support sustainable development in these regions. In contrast to earlier research that looks at the effects of climate change or specific facets of disaster management, this study explores in a novel way how disaster management mediates the connection between economic disasters and sustainable outcomes, specifically sustainable embankment and economies in Bangladesh. Considerable socioeconomic and environmental repercussions have emerged from climate change's increased regularly and intensity of economic disasters in Bangladesh's coastal regions. Effective disaster management techniques can not only lessen short-term financial losses but also support long-term sustainable development, making it an essential component in addressing these issues. However, there is still a lack of research on how much disaster management affects sustainable outcomes, especially when it comes to infrastructure stability and economic resilience. In order to close these gaps, this study looks into how economic disasters, climate change, and disaster management are interconnected in Bangladesh's coastal areas. It particularly answers the following research questions (RQ).

**RQ1:** Does climate change impact economic disasters in the coastal areas of Bangladesh?

**RQ2:** What role does disaster management play in mitigating the effects of economic disasters in Bangladesh's coastal regions?

**RQ3:** Does disaster management contribute to sustainable development in Bangladesh's coastal areas, particularly in terms of sustainable embankment and economy?

**RQ4:** How does disaster management mediate the relationship between economic disasters and sustainable outcomes in the coastal regions of Bangladesh?

This study is significant both theoretically and practically. Theoretically, it will enhance the understanding of how climate change, economic disasters, and disaster management are interconnected, contributing to the existing literature and advancing theories related to sustainable development in coastal regions. Practically, the research will offer valuable insights for policymakers and disaster management practitioners in Bangladesh, guiding the development of more effective strategies to mitigate economic disasters and promote sustainability. Ultimately, the study aims to improve community resilience and support sustainable development initiatives in vulnerable coastal areas.

## 2. Literature review and hypotheses development

### 2.1. Climate change and economic disaster in coastal area

Nowadays, there has been substantial focus on the issue of global climate change. Scientists in this domain consider climate change to be the most significant threat to humanity (Longo et al., 2024). Developing countries are very vulnerable to climate change due to its socioeconomic, hydrological, and geological aspects (Afzal et al., 2024). This issue is accelerated by tropical storms, cyclones, and more frequent and prolonged monsoon floods and erosion (Datta and Kairy, 2024). The low-elevation coastal zone (LECZ) is particularly vulnerable for poorer people in emerging nations due to climate change (Barbier, 2015). Due to climate change's effects on coastal wetlands and agriculture, LECZ's rural poor would suffer economically. Rising sea levels, storm surges, coastal erosion, and salt water intrusion threaten coastal farmers and fishermen (Tol, 2024; Luo et al., 2025). Growing coastal risks due to climate change create a serious risk to the livelihoods of low-income rural coastal people and may have indirect effects on important ecosystems (Barbier, 2015). The two types of climate change impacts that disproportionately affect low-income areas are first, temporary natural disasters like floods and storm surges and second, long-term climatic changes like sea level rise, salt intrusion, and erosion (Zhao et al., 2024). The coastal and marine systems and resources that families rely on are suffering due to these dangers, and households experience decreased earning capacity and productivity as a result (Adshead et al., 2024). Hurricanes and other significant coastal storms can destroy roads, public infrastructure, property, capital assets, and inventories, hence coastal zone studies focus on their direct and indirect costs. Climate change impacts are assessed using economic factors such business establishments, taxable sales, production, employment, housing prices, and wages (Adshead et al., 2024; Leichenko and Thomas, 2012). According to Estrada et al. (2015), researchers calculate that between 2 or 12 % of the calculated damages in 2005—\$2–\$14 billion—could be caused by climate change. LeBlanc and Linkin (2010) investigate the monetary impact on the New York metropolitan region of a storm such as the 1938 Long Island Express. Damages to insured properties would reach \$110 billion (triple Hurricane Katrina's destruction), and the New York metro area economy would suffer secondary business interruption losses totaling upwards of \$200 billion, according to the report. Thus, we deduce that the relationship is.

**H1.** Climate change positively influences the economic disaster in coastal areas

### 2.2. Economic disaster in coastal area and disaster management

The Gunawan (2024) defines a disaster as "a widespread disturbance of a community or society as a result of catastrophic incidents combined with vulnerability, susceptibility, and capability," which may lead to: adverse effects and harms on a human, material, economic, and environmental level. A majority believe that climate change is a major cause of disasters (Datta and Kairy, 2024; Zhao et al., 2024). Disaster causes are usually divided into three categories. Numerous disasters are meteorological, including floods, thunderstorms, hurricanes, typhoons, snowstorms, drought, and burning waves. Second, geological disasters like volcanoes, earthquakes, landslides, mudflows, and tsunamis kill many. The Indian Ocean tsunami of December 26, 2004, killed 230,000 and destroyed the coastal community (Cels et al., 2023; Gazi et al., 2024a,b,c). The third category is biological disasters like the COVID-19 pandemic that killed millions (Gunawan, 2024). Meteorological and geological disasters are both sources of coastal catastrophes. The comprehensive implementation of disaster risk management is crucial because disasters involve loss of life, property damage, social and economic problems, and environmental degradation (Jyotsna et al., 2024; Wang et al., 2025). Our focus is on disaster risk management, especially for reducing economic threats in coastal areas. Disaster risk management, as defined by Mizutori (2020), involves policies and strategies to prevent new risks, mitigate existing risks, manage residual risks, and reduce disaster loss globally. The disaster management cycle outlines activities for pre, during, and post-disaster stages. Pre-disaster activities include prevention, readiness, and mitigation; during-disaster include response, rescue, and relief; and post-disaster include recovery and development (Cels et al., 2023; Rehman et al., 2019; Gazi et al., 2025a,b). This framework is a global standard for disaster management by governments. Collaboration between governments, communities, and organizations is essential for effective disaster management. Preparation for dealing with economic disasters is the first step in the disaster management cycle. This includes activities like planning, training, and instruction. Establishing an early warning system, making emergency plans, providing evacuation routes, and informing

the population are all responsibilities of the local administration (Gunawan, 2024; Gazi et al., 2025a,b). Our secondary objective is response, which encompasses actions taken prior, during, or after disasters to mitigate their effects on health, ensure public safety, fulfill fundamental needs, and recoup economic damages. Lastly, assisting those impacted by disasters in their economic recovery (Cels et al., 2023; Shang and Luo, 2021). Businesses, government agencies, and individuals will work together to rebuild, provide medical assistance, and donate to those struggling after a disaster strikes (Usadhi and Sudibia, 2019; Gazi et al., 2024a,b,c). Through taking such actions, we may lessen the economic effects of the disaster and get back on our feet financially. According to other research, disaster management is necessary for economic recovery in the event of a disaster (Gunawan, 2024; Cels et al., 2023; Usadhi and Sudibia, 2019). Therefore, we postulated that the association is.

**H2.** Economic disasters in coastal areas have a positive correlation with disaster management

### 2.3. Disaster management and sustainable embankment and economy

Most notably, embankment protect people from flooding and other natural disasters. These structures are constructed to prevent land from being flooded by water (Owolabi and Daramola, 2024). The effectiveness and durability are heavily influenced by the quality of the design, construction, and maintenance. Disaster management is the process of systematically identifying, assessing, and mitigating risks associated to natural disasters (Gunawan, 2024; Youdeowei et al., 2019). The development of embankment can greatly benefit from the application of disaster management procedures (Cels et al., 2023; Mallick et al., 2011). Existing embankment can be evaluated for flaws and vulnerabilities through risk assessments, which are an integral part of disaster management. This makes it possible to strengthen or restructure embankment so that it more effectively withstands future natural disasters (Rashid et al., 2023a,b; Youdeowei et al., 2019). Moreover, the primary goal of the earthen coastal embankment built in Bangladesh in the 1960s and 1970s was to shield coastal regions from saline water incursion and tidal floods (Rahman et al., 2022; Jiao et al., 2024). Although these embankment offered instant protection and made agricultural growth easier, they also had structural flaws, frequent breaches, and long-term sustainability issues because of improper preservation, subsidence, and rising storm surges (Auerbach et al., 2014; Dewan et al., 2015).

When compared to conventional earthen embankment, the suggested concrete embankment—whether made of brick, reinforced with iron frames, or using planet blocks—offer notable gains in resilience and durability (Rahman et al., 2022). Depending on earthen structures alone is not enough for addressing rising sea levels, intensifying cyclones, and sediment instability, based on lessons learned from previous embankment operations (Higgins et al., 2018). Concrete-based embankment, on the other hand, offer improved structural integrity, lower the possibility of breaches, and require less regular maintenance (Dunn et al., 2018). Additionally, adding reinforced materials can increase resilience to storm-induced overtopping and tidal erosion, providing a more sustainable protective system (Rahman et al., 2022). The authors suggest concrete embankment made of brick, iron frameworks, or planet blocks to increase durability. These constructions are more resilient to erosion, stronger cyclones, and increasing sea levels. They also require fewer maintenance procedures. However, adaptive approaches like mangrove restoration, tidal river management, and controlled sedimentation should be used in conjunction with embankment for long-term sustainability (Rashid et al., 2022, 2023). Disaster management initiatives will be strengthened by this integrated strategy, which will ensure environmental and economic sustainability.

Although embankment offer crucial defense against saltwater intrusion and coastal flooding, they also present a number of ecological and hydrological difficulties (Wilson et al., 2017). Previous inflexible embankment in Bangladesh interfered with natural sedimentation, resulting in soil subsidence and raising the risk of flooding (Rashid et al., 2022). They also caused waterlogging and drainage congestion, which hurt livelihoods and agriculture. Improved drainage systems, sediment control, and routine monitoring are all necessary for embankment to prevent these problems (Rashid et al., 2023a,b). Sustainability can be increased by utilizing natural solutions like sediment replenishment and floodplain connectivity (Rahman et al., 2022). Involving the community in embankment planning will also guarantee prospective environmental and economic advantages (Rashid et al., 2023a,b). Moreover, proper planning and design are encouraged for efficient disaster management. This takes into account community engagement, predictive modeling, and data from past disasters (Owolabi and Daramola, 2024). By utilizing these properties, embankment can be customized to fit their environment. Because of this, embankment continue to serve their purpose and could adapt to changing conditions (Mallick et al., 2011; Chen et al., 2024). Thus, sustainable embankment will be improved by disaster management. By reducing the impact of catastrophes that are both natural and artificial on economies over the long run, disaster management contributes to keeping economies sustainable (Cvetković and Šišović, 2024). Businesses, infrastructures and the public are all safer with carefully planned disaster management strategies, which also help the economy recover more quickly and at a lesser cost (Kalogiannidis et al., 2023). By funding early warning systems and robust infrastructure, governments and organizations can keep the economy going and avoid major losses (Kalfin et al., 2022; Xu et al., 2023). Society is better positioned to adapt to future challenges and advance sustainable development when disaster management strengthens relationships. Financial strategy that incorporates disaster management strategies strengthens and secures the economy (Cvetković and Šišović, 2024; Kalogiannidis et al., 2023).

Many research has looked at how climate change affects coastal sustainability. Rahman et al. (2022) used analytical and environmental evaluations to evaluate the Ganges-Brahmaputra-Meghna delta's sustainability and found that climate and human stresses hasten environmental deterioration. The lack of a socioeconomic viewpoint in their analysis, however, restricts its relevance for disaster resilience policymaking. Similar findings were made by Rashid et al. (2023a,b), who used environmental sampling and laboratory analysis to examine water contamination in Bangladesh's southwest coastal region and identified serious health hazards. Although their findings show a clear correlation between declining water quality and public health, they don't look into how local communities deal with or reduce these hazards. Using remote sensing, NDVI, and GIS, Rashid et al. (2023a,b) investigated salinity

intrusion and its impacts on vegetation and land use. Although their study does not address the wider economic implications, such as decreased agricultural output and revenue loss among affected populations, their findings indicate that rising salinity dramatically modifies land cover patterns (Xi et al., 2022).

Despite offering important environmental insights, these studies mostly rely on secondary data and environmental evaluations, which restricts their capacity to gather information on disaster resilience and human adaptation tactics. In contrast, our study uses a quantitative survey approach to collect primary data from 405 respondents in order to evaluate how the general public views economic sustainability and disaster management. Because of this methodological change, socio-economic resilience can be directly assessed, and we can evaluate community knowledge, readiness, and response to climate-related disasters—aspects that were not included in previous studies. Furthermore, our work incorporates disaster management as a crucial mediator, empirically establishing its significance in decreasing economic vulnerabilities, whereas Rahman et al. (2022) and Rashid et al. (2023a,b) concentrate on ecological and environmental deterioration. The divergent findings point to an important research gap: prior research has focused on the effects on the environment, but has ignored the ways in which efficient disaster management can lower economic damages and improve sustainability over the long run. By connecting these facets, our study offers a more thorough understanding of climate resilience, taking into account adaptive, economic, and environmental factors to guide sustainable policy measures. Thus, we argue that the relationships are.

**H3.** Disaster management positively influence the sustainable embankment

**H4.** Disaster management positively influence the sustainable economy

#### 2.4. Sustainable embankment and sustainable economy

An embankment is a brick, planet, or iron frame built across a river or stream to decrease or manage water flow and create a reservoir (Kais and Islam, 2023). An embankment is a tourism attraction that provides jobs for unemployed people. It is a good fishing spot and a backup during droughts. Dams also create energy from water flowing by turbines (Chlahbi et al., 2024). Infrastructure projects that generate hydroelectric electricity are vital to economic development in Nigeria and elsewhere. Embankment has boosted Nigeria's economic progress by suppling 50 % of Nigeria's electricity (Gazi et al., 2024a,b,c; Youdeowei et al., 2019). Embankments have laid the groundwork for self-sufficient economic growth and addressed numerous difficulties faced by the communities they serve. There are now greater job opportunities, poverty rates are lower, rural society (including nomads) is more stable regionally, and the trend of rural residents seeking employment in cities has reversed (Amrani et al., 2020). Essentially, embankment serve as reservoirs for floodwater from rivers and allow for controlled release to accomplish various beneficial purposes (Mohanty et al., 2020; Chen et al., 2024). In this context, the variable range of availability refers to the extent to which supplies can be consistently obtained and used to maintain productivity across time (Chlahbi et al., 2024; Amrani et al., 2020; Youdeowei et al., 2019). The hypothesis is as follows.

**H5.** Sustainable embankment positively influence sustainable economy

#### 2.5. Disaster management play as a mediating role

Prior research has demonstrated the vital importance of fully implementing disaster risk management due to the significant consequences of disasters, including loss of life, asset destruction, social and economic challenges, and environmental deterioration (Gunawan, 2024; Cels et al., 2023; Usadhi and Sudibia, 2019). Therefore, it is crucial to formulate disaster management strategies to address the issues arising from disasters. Additionally, other researchers discovered that disaster management will improve sustainable embankment by addressing environmental considerations, improving planning and design, and enhancing structural integrity (Mallick

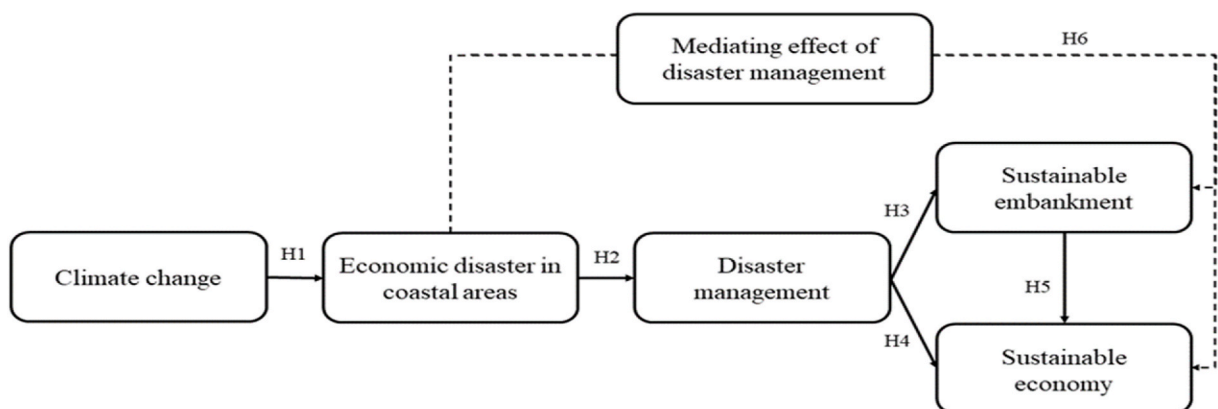


Fig. 1. Conceptual framework.

et al., 2011). And disaster management contributes to the sustainability of economies by mitigating the long-term effects of both natural and artificial disasters on them (Cvetković and Šišović, 2024). In the event of an economic disaster, disaster management is necessary, and it subsequently enhances the sustainability of the economy and embarkation. Consequently, it can be argued that disaster management indirectly affects the relationship between economic disaster and sustainable embankment and economy. For this reason, the hypothesis is as follows.

**H6a.** Disaster management positively mediate the relationship between economic disaster and sustainable embankment

**H6b.** Disaster management positively mediate the relationship between economic disaster and sustainable economy

Based on previous literature review and hypotheses formulation the following conceptual framework are given (figure-1)

### 3. Methodology

#### 3.1. Research design

Based on the study, we developed our survey questionnaire in three steps. Based on the research, we are creating our survey questionnaire. Three government-experienced research experts carefully selected the research questions in a focus group. We deleted unnecessary questionnaires and simplified the most important ones after careful consideration, improving readability and clarity. Before analyzing our sample data, we are pilot testing it to confirm its validity. We evaluate 40 randomly selected samples to establish measurement question adequacy. Using our pilot test results, our data is ready for analysis. The reliability test evaluated the minimum Cronbach's Alpha value of 0.70 ( $\alpha > 0.70$ ) for each construct, yielding positive results. After examining the responses, we found minor difficulties with language in a few questions and updated them to improve clarity and comprehension. For example, the phrase CC3 means "I am persuaded that the existential dangers presented by climate change have the potential to jeopardize my safety and survival". As it became more sophisticated, we rewrote it as "I believe that climate change can endanger my life". Before finishing the questionnaire, these changes were made to ensure that all items were easily understandable.

The survey consisted of three parts. Participants are invited to engage in the research study in the first section and assured that their responses will be secret and applied just for study. The second section has demographics. The last segment used 25 first-order contrasts with 5 questions each to assess agency personnel' views on disaster management during economic disasters in coastal areas (see Appendix-A). The question items for climate change were collected from existing literatures (Semenza et al., 2011; Schuldt et al., 2015; Ali et al., 2020). Economic disaster in coastal area and disaster management questions were adopted from (Ali et al., 2020) and (Alshehri et al., 2012). Lastly, the items of sustainable embankment and sustainable economy were collected from (Mahtab et al., 2018) and (Cvetković and Šišović, 2024; Ma et al., 2023). A seven-point Likert scale was used to score the questions in section 3.

#### 3.2. Data collection

Experts from the National Emergency Management Agency, Fire Service, Federal Road Safety Commission, Senior Police Officers, and others who manage coastal economic disasters were our target populations. Convenience sampling was implemented to ensure efficient access to professionals managing coastal economic disasters, such as experts from the National Emergency Management Agency, Fire Service, Federal Road Safety Commission, and senior police officials. While this approach is useful for getting data easily, it may add selection bias, reducing generalizability (Gazi et al., 2025a,b). To counteract these biases, we used a Common Method Variance (CMV) test (described in Section 3.4) to analyze and correct for any variance caused by data collection from a single source. Moreover, anonymity was ensured, and various question formats were utilized to limit the danger of social desirability bias. These parameters improve the reliability of the findings, despite the limits of convenience sampling. We set up an online survey in Bangladesh using a Google form. In the months of April through May of 2024, information was randomly collected from many online networks and social media sites, including Facebook, Messenger, WhatsApp, email, and many more. No values were missing from the 405 questionnaires that were received. Researchers utilized Kothari's (2004) finite population sample size determination formula with a 95 % confidence level (equivalent to a Z value of 1.96), an error term of 5 %, and a standard deviation of 0.5 because the respondents are known and finite. And, finally we kept 405 valid responses for analysis.

#### 3.3. Data analysis tools

This study utilized Amos-24 to investigate hypothetical paths using SEM. IBM SPSS statistics-24 displays descriptive and demographic data. The SEM validates the hypothesized routes, and the measurement model is assessed for accuracy and data reliability.

#### 3.4. Common method variance

The CMV test was done using Harman's single factor test. Podsakoff et al. (2003) report CMV problems if every item comes under the same factor or if one factor explains for more than 50 % of variation. Test findings from Podsakoff et al. (2003) show that the first component accounts for 28.53 % of variation and that few factors have eigenvalues greater than 1. This suggests no CMV concerns in the data.

## 4. Data analysis and results

### 4.1. Socio-demographic profile of the respondents

Participant demographics are shown in [Table 1](#). Total 56 % of the sample is male and 44 % female. Singles were 54.8 % and married 45.2 %. The education level of survey participants was 4.9 % and 24.6 % PHD and postgraduate degrees. And 31.4 % and 39.1 % was graduate and intermediate level. Here the demographic analysis shows employees of working agencies who are handle economic disaster in coastal area. Data gathered via organized questionnaires sent to important regional participants, such as residents, volunteers, public servants, and specialists in disaster management (see [Table 1](#)).

### 4.2. Inter item correlation matrix

The inter-item correlation matrix in [Table 2](#) shows that the five items (CC, EDC, DM, SEM, and SEC) have comparatively low positive correlations with coefficients ranging from 0.112 to 0.255. In particular, there are positive correlations between CC and SEM (0.183), CC and SEC (0.246), CC and DM (0.255), CC and SEM (0.198), CC and SEC (0.246), EDC and DM (0.159), EDC and SEM (0.112), EDC and SEC (0.178), DM and SEM (0.137), DM and SEC (0.161), and SEM and SEC (0.127).

### 4.3. Overall exploratory factor analysis (EFA) results

The results of an exploratory factor analysis (EFA) using principal component analysis (PCA) are presented in [Table 3](#). Prior to starting the analysis, the data's suitability for factor examination was evaluated by carefully examining the correlation matrix, which revealed sufficient correlations between the variables. [Fornell and Larcker \(1981\)](#) suggest a factor loading cut-off of 0.70. The similarities between our measurements, which ranged from 0.865 to 0.950, were all statistically significant. As shown in [Table 3](#), the respondents' mean answers ranged from 5.57 to 5.85, with standard deviations ranging from 1.215 to 1.581. Skewness and kurtosis verified data consistency. For data to be considered normal, skewness and kurtosis must be within  $\pm 2.00$ . Table skewness and kurtosis values are within the acceptable range, indicating proper data collection. The data reflect each question's lowest and highest answer rates. [Hair et al. \(1988\)](#) found that composite Cronbach's alpha ( $\alpha > 0.70$ ) and CR  $> 0.70$  demonstrated satisfactory dependability. [Table 3](#) illustrates how closely respondents' responses fit each of the five components.

### 4.4. Measurement model analysis

In this study, confirmatory factor analysis (CFA) was used after EFA. [Table 4](#) explains the validity and reliability of the measurement model, which is depicted in [Fig. 2](#). The results show internal strong consistency, with both Cronbach's alpha ([Table 3](#)) and CR scores exceeding the suggested cutoff value of 0.70, with values ranging from 0.930 to 0.968. The acceptable safeguard of 0.50 is likewise exceeded by the AVE values, which range from 0.728 to 0.859. Additionally, as shown by [Fornell and Larcker \(1981\)](#) and [Hair Jnr et al. \(2010\)](#), there is discriminant and divergent validity because the inter-construct correlation value is less than the square root of the AVEs. The model's VIF scores, which range from 1.049 to 1.123, show that multicollinearity issues are not present. The model showed good fit based on several generally used fit indices, such as chi-square of degrees of freedom ( $X^2/d > 3$ ), CFI ( $> 0.90$ ), GFI ( $> 0.85$ ), AGFI ( $> 0.80$ ), and RMSEA ( $< 0.05$ ), which were used to assess the overall model fit ([Fornell and Larcker, 1981](#)) (see [Table 4](#)).

### 4.5. Structural model analysis

This study applies structural model analysis to investigate the relationships among Climate Change, Economic Disaster in Coastal Area, Disaster Management, Sustainable Embankment, Sustainable Economy, as well as to assess the validity of measurement models ([Figure-3](#)). The SEM model shows a good fit to the data, as shown in [Table 5](#) ( $X^2/df. = 1.648$ , AGFI = 0.887, GFI = 0.905, CFI = 0.981,

**Table-1**  
Respondent's profile.

Demographics (Total = 405)		Frequency	%
Gender	Male	227	56.0
	Female	178	44.0
Marital status	Single	222	54.8
	Married	183	45.2
Age	16–25 years	113	27.9
	26–35 years	115	28.4
	36–45 years	63	15.6
	46–55 years	78	19.3
	Above 56 years	36	8.9
Level of Education	Intermediate	158	39.1
	Graduate	127	31.4
	Post Graduate	100	24.6
	PHD	20	4.9

**Table-2**  
Inter item Correlation Matrix.

	CC	EDC	DM	SEM	SEC
CC	<b>1.000</b>	0.255	0.198	0.183	0.246
EDC	0.255	<b>1.000</b>	0.159	0.112	0.178
DM	0.198	0.159	<b>1.000</b>	0.137	0.161
SEM	0.183	0.112	0.137	<b>1.000</b>	0.127
SEC	0.246	0.178	0.161	0.127	<b>1.000</b>

**Table-3**  
Overall Exploratory Factor Analysis (EFA) results.

Item	Mean	Standard Deviation	Skew	Kurtosis	Min	Max	$\alpha$	Loading
CC1	5.83	1.139	-1.506	2.827	1	7	0.929	0.895
CC2	5.68	1.295	-1.485	2.348	1	7		0.899
CC3	5.79	1.299	-1.650	2.769	1	7		0.886
CC4	5.74	1.369	-1.465	1.952	1	7		0.875
CC5	5.85	1.269	-1.726	3.365	1	7		0.865
EDC1	5.71	1.310	-1.526	2.459	1	7	0.940	0.892
EDC2	5.70	1.310	-1.474	1.836	1	7		0.902
EDC3	5.60	1.422	-1.381	1.486	1	7		0.901
EDC4	5.79	1.300	-1.696	2.739	1	7		0.901
EDC5	5.79	1.308	-1.474	1.871	1	7		0.895
DM1	5.82	1.272	-1.492	1.960	1	7	0.967	0.948
DM2	5.72	1.466	-1.471	1.515	1	7		0.944
DM3	5.66	1.505	-1.346	0.928	1	7		0.941
DM4	5.67	1.502	-1.522	1.660	1	7		0.947
DM5	5.76	1.331	-1.611	2.414	1	7		0.930
SEM1	5.72	1.373	-1.466	1.844	1	7	0.965	0.920
SEM2	5.57	1.581	-1.422	1.182	1	7		0.938
SEM3	5.58	1.506	-1.458	1.412	1	7		0.947
SEM4	5.62	1.492	-1.616	1.949	1	7		0.950
SEM5	5.63	1.406	-1.427	1.662	1	7		0.929
SEC1	5.79	1.215	-1.580	2.539	1	7	0.951	0.919
SEC2	5.76	1.231	-1.297	1.443	1	7		0.894
SEC3	5.70	1.319	-1.433	1.851	1	7		0.912
SEC4	5.85	1.242	-1.703	3.162	1	7		0.924
SEC5	5.75	1.266	-1.580	2.533	1	7		0.919

**Table-4**  
Master validity.

	CR	AVE	MSV	MaxR(H)	DM	SEM	SEC	EDC	CC	VIF
DM	0.968	0.859	0.044	0.968	<b>0.927</b>					1.065
SEM	0.965	0.847	0.039	0.967	0.144**	<b>0.920</b>				1.049
SEC	0.951	0.794	0.072	0.951	0.165**	0.132*	<b>0.891</b>			
EDC	0.940	0.758	0.076	0.941	0.168**	0.119*	0.190***	<b>0.871</b>		1.087
CC	0.930	0.728	0.076	0.933	0.209***	0.197***	0.268***	0.276***	<b>0.853</b>	1.123

CMIN/DF = 1.587, CFI = 0.985, TLI = 0.983, IFI = 0.985, NFI = 0.961, RMSEA = 0.038, GFI = 0.922, AGFI = 0.904.

TLI = 0.979, IFI = 0.981, RMSEA = 0.040, Pclose = 0.997).

The study indicates that hypothesis **H1** propose a positive correlation between climate change and Economic Disaster in Coastal Area (EDC). This study discovered a substantial correlation between climate change and increased EDC levels ( $\beta = 0.277$ ,  $p < 0.05$ ), hence supporting hypothesis **H1**. In addition, this study evaluated the influence of EDC on disaster management (**H2**). The data indicated that exposure to EDC had a positive and significant impact on DM ( $\beta = 0.172$ ,  $p < 0.05$ ), therefore confirming the validity of **H2**. Additionally, hypotheses **H3** and **H4** examined the impact of DM on both Sustainable Embankment (SEM) and Sustainable Economy (SEC) ( $\beta = 0.145$  and  $\beta = 0.150$ ). This study found that DM had a beneficial influence on SEM and SEC and P value is less than 0.05 which supported **H3** and **H4**. And lastly, **Table-5** indicates that SEM has significantly impact on SEC ( $\beta = 0.110$ ) and also statistically supported ( $p < 0.05$ ). So, **H5** also supported (**Table-5**). The findings show that CC is the cause of EDC, and EDC has a favorable impact on DM. DM also improves SEM and SEC, which closes our research gap and provides answers to RQ1, RQ2, and RQ3 as well.

The findings show that climate change has a major impact on EDC, emphasizing the need for hostile climate adaptation programs. Given EDC's significant impact on DM, policymakers should prioritize improving early warning systems, climate-resilient infrastructure, and emergency response systems. Additionally, the favorable effects of DM on SEM and SEC indicate that investing in

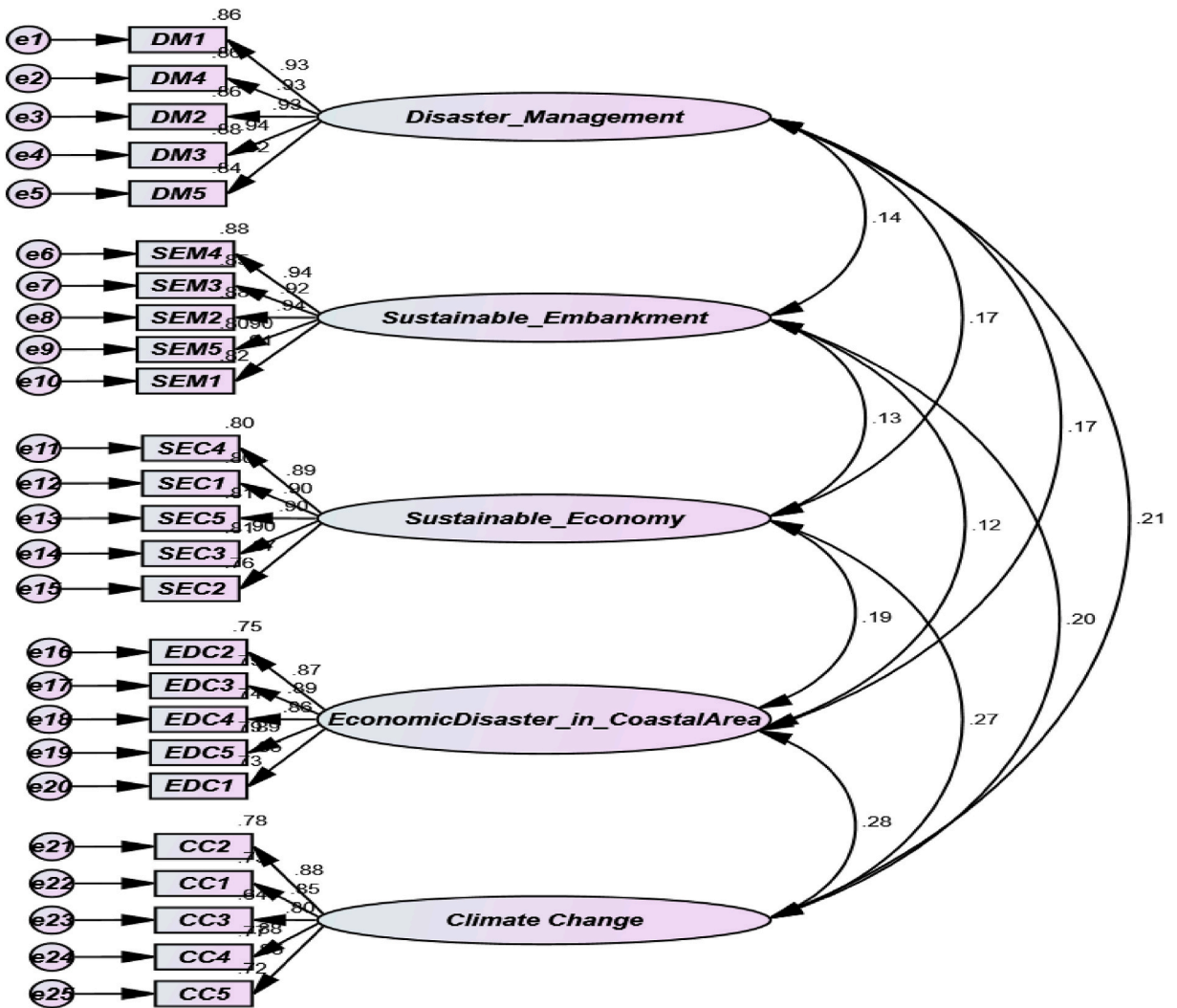


Fig. 2. Measurement model analysis.

sustainable embankment structures can improve long-term economic resilience. These findings emphasize the importance of integrated disaster risk reduction strategies that include sustainable land use planning, coastal defense measures, and community involvement in disaster preparedness activities.

#### 4.6. Mediation analysis

This study conducted a bootstrapping to evaluate the mediating effects in the model using the recommendations of (Baron and Kenny, 1986; Feng et al., 2025). Using bootstrapping with a sample size of 405, a 95 % confidence interval, and 5000 repetitions, this study utilizes the concept of mediation. Table-6 indicates that disaster management (DM) indirectly impacted on Economic Disaster in Coastal Area (EDC) and Sustainable Embankment (SEM) and Sustainable Economy (SEC). Table 6 represents that DM indirectly impacts both the relationship between EDC to sustainable embankment and the sustainable economy, and the estimated values are 0.022 and 0.026, and both relations are statistically supported because the P value is less than 0.05 and the lower bound and upper bound values are both positive (Baron and Kenny, 1986). So, the mediation hypothesis H6 is supported (Figure-4). This noteworthy mediation effect identifies our research gap and offers the response to RQ4.

The mediation study shows that disaster management plays an essential role in relating economic disaster exposure to long-term effects. This implies that government agencies and disaster management bodies should implement comprehensive plans that not only tackle natural disasters but also foster a sustainable future through adaptable infrastructures financial support for affected populations, and public-private collaboration for disaster recovery and resilience building. Policymakers can reduce the negative consequences of economic disasters and improve coastal sustainability by putting these measures in place.

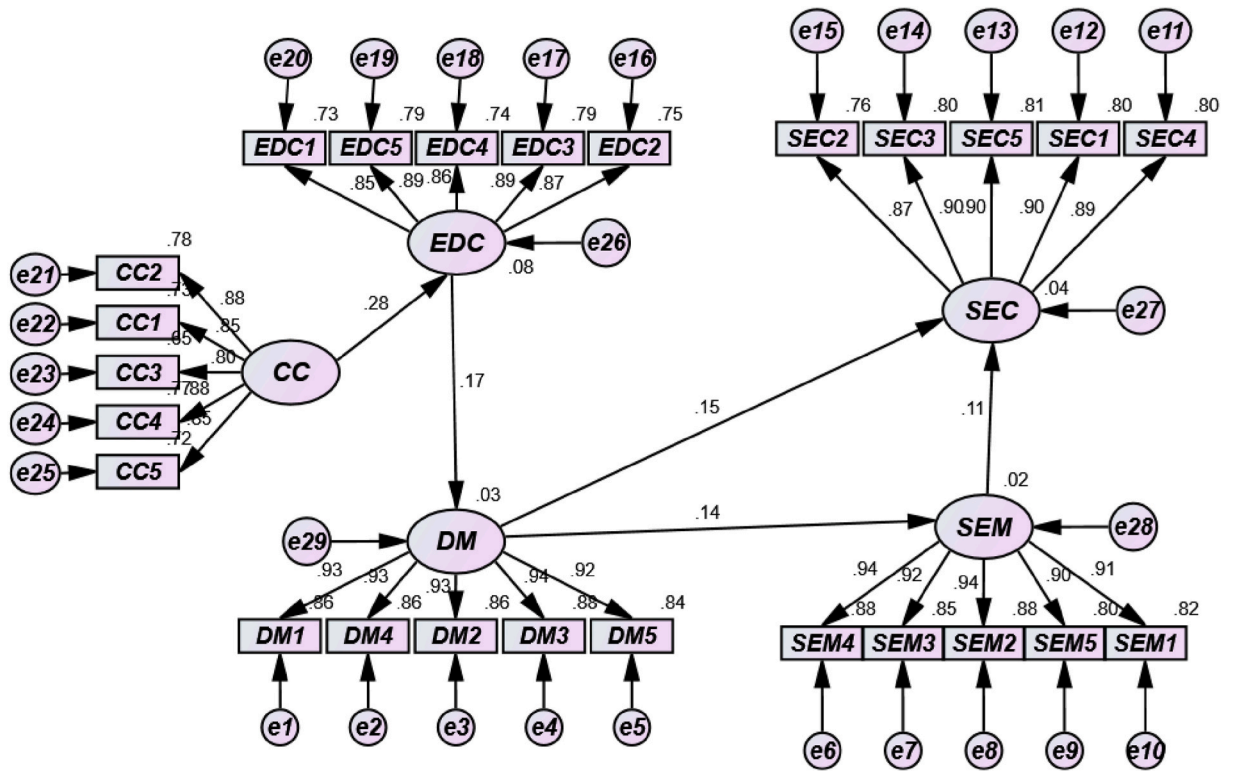


Fig. 3. Structural equation model.

Table-5  
Hypotheses results.

Results	Factors	Estimate	S.E & T value	P value	Hypothesis	Decision
Economic Disaster in Coastal Area (EDC) (R <sup>2</sup> = 8 %)	EDC ← CC	0.277	0.052 (5.305)	***		Accepted
Disaster Management (DM) (R <sup>2</sup> = 3 %)	DM ← EDC	0.172	0.054 (3.327)	***		Accepted
Sustainable Embankment (SEM) (R <sup>2</sup> = 2 %)	SEM ← DM	0.145	0.061 (2.831)	0.005		Accepted
Sustainable Economy (SEC) (R <sup>2</sup> = 4 %)	SEC ← DM	0.150	0.049 (2.911)	0.004		Accepted
	SEC ← SEM	0.110	0.042 (2.136)	0.033		

Model fit indices:  $\chi^2/d = 1.730$ , GFI = 0.914, AGFI = 0.897, CFI = 0.981, TLI = 0.979, IFI = 0.981, NFI = 0.957, RMSEA = 0.043.

Notes: p > 0.05 = not significant and \*\*\* or p < 0.05 is accepted.

Table-6  
Mediation analysis.

Variables	Estimate	Bootstrapping		
		Bias-corrected		
		95 % CI		
Indirect Effect		Lower	Upper	P
Economic Disaster in Coastal Area → Disaster Management → Sustainable Embankment	0.022	0.005	0.054	0.001
Economic Disaster in Coastal Area → Disaster Management → Sustainable Economy	0.026	0.007	0.061	0.001
Total Effect	0.047	0.014	0.111	0

Notes: P < 0.05 significant; P > 0.05 insignificant; CI= Confidence Interval; the process repeated 5000 times.

Note: This table summarizes the mediation analysis findings, emphasizing the indirect impacts of Disaster Management on Economic Disaster in Coastal Area to Sustainable Embankment and Economy. The table contains confidence intervals and significance levels to show the strength and direction of mediation.

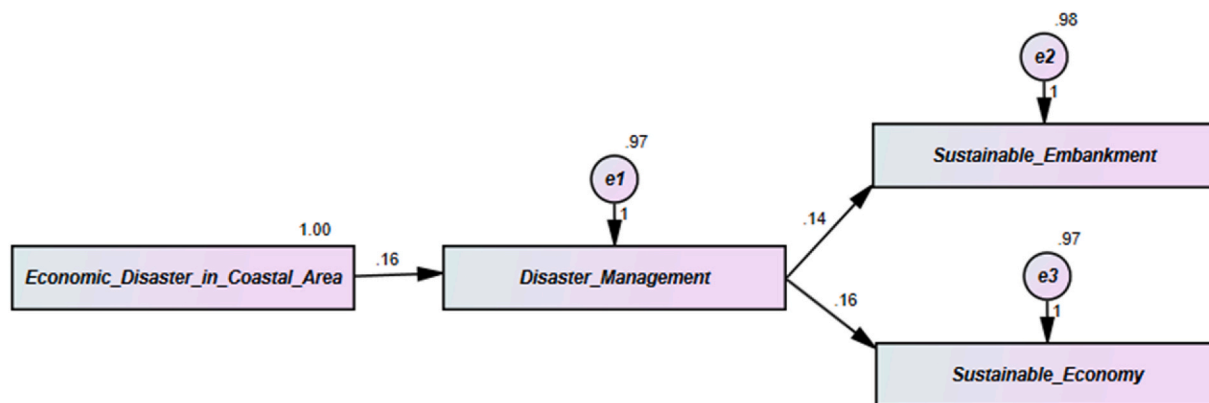


Fig. 4. Mediation Figure

Note: This figure illustrates the mediation model, specifically how Disaster Management effects the link between Management on Economic Disaster in Coastal Area to Sustainable Embankment and Economy. The direct and indirect channels are indicated with standardized coefficients and significance levels for easier interpretation.

## 5. Discussion

This study finds that climate change is the primary cause of economic disasters in coastal regions. Disaster management is used to address this issue and promote sustainable economic and embankment growth and development. Firstly, results show that climate change has a positive ( $\beta = 0.277$ ) and significant ( $p < 0.05$ ) impact on economic disasters in coastal areas, and its t-value is 5.305, which supports H1 and revealed the answer of RQ1 (see Table 5). Other authors also found that climate change is the cause of economic disaster (Datta and Kairy, 2024; Tol, 2024; Barbier, 2015). Although other research has shown that climate change contributes to economic disasters (Datta and Kairy, 2024; Tol, 2024; Barbier, 2015; Du et al., 2024), our findings are distinctive because it focuses on coastal regions, providing specific insights into vulnerabilities and adaptive capacity in these vulnerable regions. Moreover, while our results are consistent with previous research, we found that residents of coastal areas suffer significantly greater economic damages, which indicates the need for focused mitigation measures. The investigation implies that economic disaster in coastal regions is significantly influenced by climate change.

Secondly, the result of Table 5 also suggests that economic disasters are positively and significantly related to disaster management ( $\beta = 0.172$ ,  $p < 0.05$ , and t-value = 3.327), which also supports H2. This positive relationship is also supported by other researchers (Gunawan, 2024; Cels et al., 2023; Usadhi and Sudibia, 2019). This finding implies that economic disaster needs to be handled through disaster management. In accordance with earlier studies (Gunawan, 2024; Cels et al., 2023; Jiang et al., 2023), our investigation indicates a strong positive correlation between disaster management and economic disasters (Chen et al., 2024). Our study, however, contributes to this understanding by investigating this link in the context of Bangladesh's coastal regions, where resource limitations and physical vulnerabilities make economic disasters particularly challenging. Our findings, in contrast to previous research, are founded on opinions from professionals who work closely in disaster management, such as senior police officers, members of the Federal Road Safety Commission, Fire Service, and National Emergency Management Agency. A more sensible and policy-focused understanding of disaster response tactics is offered by this expert-driven viewpoint. These contributions add to the body of knowledge already in existence and provide practitioners and policymakers looking to strengthen coastal economies' resilience to disasters with insightful information. The authors therefore come to the conclusion that disaster management reduces the impact of economic disaster, thereby responding to RQ2.

Thirdly, Table 5 indicates that disaster management significantly and statistically ( $p < 0.05$ ) impacts sustainable economic ( $\beta = 0.150$  and t-value = 2.831) and embankment development ( $\beta = 0.145$  and t-value = 2.911), which proved H3 and H4. This result suggests that proper disaster management is influential for sustainable economic and embankment development, which provide the answer to RQ3. Our findings are also supported by other scholars (Cvetković and Šišović, 2024; Kalčin et al., 2022; Youdeowei et al., 2019; Mallick et al., 2011). The innovative aspect of our study is its comprehensive procedure, which shows how disaster management promotes sustained economic and embankment growth in coastal areas in addition to reducing immediate threats. In contrast to other research that looks at these factors separately, our results provide a clear empirical connection between disaster management tactics and their dual function in enhancing the architecture of embankment and fostering economic resilience. This knowledge is important for policymakers and practitioners not only in Bangladesh but also around the globe because it provides practical ways to improve economic sustainability and fortify coastal protection systems. As a result, our study fills a significant research gap by offering a thorough framework that emphasizes the advantages of disaster management in the long run, beyond responding to crises.

Fourthly, the results presented in Table 5 indicate a significant and positive correlation between sustainable embankment and a sustainable economy ( $\beta = 0.110$ ,  $p < 0.05$ , and t-value = 2.136) which validated H5. It has been observed by several researchers that a positive correlation exists between sustainable development and a sustainable economy (Chlahbi et al., 2024; Kais and Islam, 2023; Youdeowei et al., 2019). This finding implies that a sustainable economy is greatly influenced by sustainable embankment. This

study's uniqueness comes from its examination of the specific role that sustainable embankment plays in a sustainable coastal economy—a factor that has been ignored in previous studies. The methods by which embankment promotes economic sustainability, such as encouraging embankment tourism and reducing losses from disasters, etc., are highlighted in this study, in contrast to earlier research, which generally links embankment to economic outcomes. Policymakers and coastal planners can benefit from these insights, which highlight the necessity of sustainable embankment strategies that protect communities from environmental threats while also opening up economic opportunities. This will ultimately lead to sustainable coastal resilience and economic prosperity.

Lastly, [Table 6](#) demonstrates that disaster management significantly ( $p < 0.05$ ) mediates the relationship between economic disasters in coastal areas and sustainable embankment and sustainable economy. Furthermore, the estimated values of this mediation are 0.022 and 0.026, which support [H6a](#) and [H6b](#) and present an explanation for RQ4. Other studies found that economic disasters are positively linked with disaster management ([Gunawan, 2024](#); [Cels et al., 2023](#); [Usadhi and Sudibia, 2019](#)), and disaster management has an influential correlation with sustainable economies and embankment ([Cvetković and Šišović, 2024](#); [Youdeowei et al., 2019](#); [Mallick et al., 2011](#); [Mia and Islam, 2005](#)). That means disaster management indirectly impacts the relationship between economic disasters and sustainable embankment, and sustainable economy. Finding the indirect effect of disaster management on the relationship between economic disasters and sustainable development and a sustainable economy, which is an area that previous research has ignored, makes this study intriguing. This study offers empirical evidence of disaster management as a mediator, underscoring its crucial role in influencing sustainable outcomes, even if previous research has demonstrated direct links. These findings highlight the necessity for coastal management authorities and policymakers to fortify disaster management frameworks, not only as a reactive measure but also as a strategic facilitator for sustainable infrastructure and economic sustainability in coastal regions that are vulnerable to disasters.

## 6. Conclusion and future guideline

This study investigates that how climate change occurs economic disasters in coastal regions and the application of disaster management will help to solve this problem which in turn on sustainable embankment and economy. Our research questions (RQs) are: RQ1: How does climate change impact economic disasters in the coastal areas of Bangladesh? RQ2: What role does disaster management play in mitigating the effects of economic disasters in Bangladesh's coastal regions? RQ3: How does disaster management contribute to sustainable development in Bangladesh's coastal areas, particularly in terms of sustainable embankment and economy? RQ4: How does disaster management mediate the relationship between economic disasters and sustainable outcomes in the coastal regions of Bangladesh? The answers of these questions are provided in the result section see [Tables 4 and 5](#) This study emphasizes the critical need to tackle economic sustainability and embankment resilience as a combined strategy to prevent economic disasters in vulnerable areas, with a focus on Bangladesh's coastal regions. This method gives conversations on climate adaptation and regional development a fresh perspective.

However, the study had certain drawbacks. Firstly, convenience sampling might restrict the findings' generalizability outside the selected respondents. Secondly, the study's cross-sectional design prohibits the evaluation of long-term disaster management outcomes. Thirdly, while disaster management was examined as a mediating factor, other potential moderators (such as government policies, technical improvements, and socioeconomic situations) were not considered.

Future research should overcome these shortcomings by conducting longitudinal studies that track the long-term benefits of disaster management initiatives. Furthermore, broadening the scope of study to incorporate multiple stakeholder viewpoints, such as local communities, policymakers, and non-governmental organizations (NGOs), could lead to a more complete understanding. Additionally, improving embankment structures, encouraging alternative livelihoods, and bolstering community-based adaptation, future guidelines could concentrate on integrating climate-resilient infrastructure and sustainable economic practices in Bangladesh's coastal regions in order to reduce the risks of climate-induced economic collapse. Moreover, further investigations should look into how anthropogenic activities and climate change interact to cause coastal economic disasters. Our future study will attempt to investigate that through applying a suitable methodological approach.

### 6.1. Theoretical contribution

This paper contributes theoretically to climate change, economic calamities, and sustainable development, particularly in coastal areas. First, it experiments with climate change's favorable effect on economic disasters. The study highlights the direct impact of environmental changes on economic stability in coastal regions, adding to the discussion about how vulnerable places are disproportionately affected by climate change. The study establishes a strong association between economic calamities and the need for competent disaster management solutions, filling a gap in disaster management literature. This research advances disaster preparedness and response theory by emphasizing the importance of proactive catastrophe management in minimizing economic disruptions. This research also examines how disaster management promotes sustainable embankment and economic resilience in coastal locations, adding to sustainable development literature. Well-managed catastrophe response can spur sustainable development, especially in environmentally vulnerable areas. Disaster management is introduced as a mediator between economic calamities and sustainable development results. This mediation is empirically tested to reveal how disaster management can turn economic disasters into sustainable development opportunities, providing a more nuanced understanding of the disaster-development nexus.

## 6.2. Practical implications

This study has practical implications for coastal management policymakers, practitioners, and stakeholders promoting sustainable development. Policymakers should focus on how climate change affects coastal economies and include adaptation measures in economic planning. This preemptive approach will lessen climate change risks and provide economic stability in vulnerable areas. For example, improving early warning mechanisms through immediate disaster tracking and community-based warnings can greatly reduce damages from cyclones and storm surges. Incorporating sustainable embankments into wider disaster risk reduction plans should be a top priority for policymakers in order to guarantee that these embankments are robust and support long-term coastal protection. The study emphasizes the need for strong disaster management systems that address calamities and promote sustainable development. Sustainable protection and economic adaptation are essential for coastal regions' long-term existence; therefore, disaster management techniques should be effective. The strong correlation between sustainable development and a sustainable economy underlines the need for sustainable infrastructure. Urban planners, engineers, and environmentalists must prioritize climate-resistant infrastructure that boosts economic growth. This investment is crucial for coastal communities' future. For instance, investing in climate-resilient infrastructure, such as cyclone shelters, flood-resistant homes, and enhanced drainage systems, is essential for mitigating disaster-related economic losses. This study also emphasizes disaster management's role in communication and conflict resolution. Disaster management experts need better training and skills. Disaster management can better achieve sustainable development goals by equipping these specialists with the necessary knowledge and skills. Authorities such as the Fire Service, Federal Road Safety Commission, and National Emergency Management Agency should improve their catastrophe readiness and response programs. Economic development policies must include climate change adaptation, disaster risk reduction, and sustainability to promote broad success. For example, economic policy should incorporate financial relief programs and insurance mechanisms to assist coastal organizations damaged by natural catastrophes. This method will reduce climate change-related economic vulnerabilities and promote coastal economic sustainability.

## 6.3. Limitations

There are various challenges to overcome in the research of the relationship between a sustainable economy and sustainable embankment in Bangladesh's coastal regions in light of climate change. Initially, it is challenging to produce accurate projections, which may distort the precision of our results. There are occasionally insufficient or contradictory data on the long-term impacts of climate change and the economic results in these regions. Because of this, it is difficult to form firm judgments regarding potential trends and policy suggestions. Moreover, it is difficult to completely predict these variables due to the variability of regional ecosystems and socioeconomic conditions. Because of this, the results might not accurately reflect the intricacy of local situations, which could restrict how broadly our findings can be applied. Future study could overcome this constraint by combining qualitative and quantitative techniques to better represent the variety of viewpoints and circumstances seen in coastal regions.

The application of sustainable solutions is made more difficult by the dependence on possibly insufficient current infrastructure. This could affect the suggested solutions' practical viability because actual circumstances might make it impossible for them to be fully implemented. Furthermore, the efficiency of suggested techniques may be impacted by outside variables like changes in international aid and global market volatility, which restricts the potential applications of strictly local interventions. It would be beneficial to incorporate more general economic and geopolitical elements as moderating variables in future studies to gain a better understanding of the ways in which these international pressures influence regional sustainability initiatives.

Finally, the study's absence of human activity as a contributing factor to coastal economic disasters is constitutes another of the primary drawbacks. Although a lot of research has shown that human-induced changes like embankment construction, river diversion, land use changes, and sediment management also significantly influence coastal vulnerability, climate change is a major driver of environmental changes in the Ganges-Brahmaputra-Meghna (GBM) delta (Auerbach et al., 2015; Higgins et al., 2018; Dunn et al., 2018; Rahman et al., 2022; Rashid, 2023). However, because of the study's scope and data limitations, we are unable to directly analyze anthropogenic influences and instead continue to concentrate on climate-induced consequences. As earlier studies said, we acknowledge the importance of environmental changes generated through humans and their interaction with climate-related stresses (Rashid et al., 2023a,b; Wilson et al., 2017; Byuro; Hu and Bentler, 1999). Future research should take into account both anthropogenic and climate-induced factors to overcome this constraint and present an improved understanding of coastal resilience and vulnerability.

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## CRedit authorship contribution statement

**Md. Abu Issa Gazi:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Resources, Project administration, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Abdullah Al Masud:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Investigation, Formal analysis, Data curation. **Md. Kazi Hafizur Rahman:** Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Methodology, Investigation, Data curation. **Mohammad Bin Amin:** Writing – review & editing, Validation, Supervision, Resources, Funding

acquisition, Data curation. **Md. Emon:** Writing – review & editing, Visualization, Validation, Software, Resources, Investigation, Data curation, Conceptualization. **Abdul Rahman bin S Senathirajah:** Writing – review & editing, Visualization, Validation, Supervision, Investigation, Data curation. **Masuk Abdullah:** Writing – review & editing, Visualization, Supervision, Resources, Investigation, Funding acquisition, Data curation.

### Declaration of competing interest

Authors are declaring there is no Conflict of Interest.

### Appendix A. Measurement Constructs

Constructs	Items	Sources	
Climate Change	CC1	Climate change could affect my lifestyle if I don't prepare.	(Semenza et al., 2011; Scholdt et al., 2015; Ali et al., 2020)
	CC2	In my consideration climate change to be the most serious problem currently facing the world as a whole.	
	CC3	I believe that climate change can endanger my life.	
	CC4	Climate change will also effect of coastal communities' livelihood those are dependent of fishing	
	CC5	Climate change will also effect of coastal communities' livelihood those are dependent of tourism.	
Economic Disaster in Coastal Area	EDC1	Climatic changes cause crop damages leading to high production cost in coastal area.	Ali et al. (2020)
	EDC2	Climatic changes cause crop damage leading to low productivity in coastal area.	
	EDC3	Climate change increases the amount of loss of property assets in coastal area	
	EDC4	Climatic changes increase damage rate to homes and infrastructures in coastal area	
	EDC5	Climatic changes increase in the seasonal unemployment rate in coastal area	
Disaster Management	DM1	I know what to do in the event of a disaster	Alshehri et al. (2012)
	DM2	I can help my family and others during a disaster	
	DM3	I can personally contribute to reduce the risk of disaster	
	DM4	I am aware of the emergency procedures I need to follow in a disaster warning issue	
	DM5	I will comply with the evacuation procedure under any circumstances	
Sustainable Embankment	SEM1	Sustainable Embankment can increase agricultural production.	Mahtab et al. (2018)
	SEM2	Sustainable Embankment can provide good road communication and contribute to the improvement of the overall socio-economic condition in the coastal zone.	
	SEM3	Sustainable Embankment Relatively low cost of construction and maintenance.	
	SEM4	Sustainable Embankment helps to Reduced risk of flooding elsewhere.	
	SEM5	Disaster management practices help in preventing erosion and degradation of embankment over time.	
Sustainable Economy	SEC1	Effective disaster management policies contribute to the resilience of the economy	Cvetković and Šišović (2024)
	SEC2	Disaster planning leads to reduced economic losses during crises.	
	SEC3	Investing in disaster preparedness positively impact long-term economic sustainability	
	SEC4	Effective disaster response mechanisms can expedite economic recovery post-disaster	
	SEC5	Integrating disaster risk reduction into economic development plans fosters sustainable growth	

### Data availability

Data will be made available on request.

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