

**A critical study on the eastern coastal zone of Bangladesh: Policy Implication for
development**

**Um estudo crítico sobre a zona costeira oriental de Bangladesh: Política Implicação para
o desenvolvimento**

**Un estudio crítico sobre la zona costera oriental de Bangladesh: Política Implicación
para el desarrollo**

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Abstract

Coastal Zone is an area where ocean, land, and environment interact with one another; therefore, it is lively and varied in nature. The coastal zones in Bangladesh is being frequently attacked by cyclones, storm surge, sea level rise, which have affected terribly this low lying coastal zone. The multifaceted coastal zone prerequisites all-inclusive integrated

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approaches to manage. This study aims to identify the background of the socio-economic problems of the people of coastal zone particularly in the eastern belt. It also discusses the various problems along the coastal areas, and the rationality of coastal governance and management for sustainable development, framework for solving the coastal issues in the eastern zone, climate change and environmental impacts, and policy recommendations for coastal development and management so as to adapt climate change vulnerability (Ahmad, 2019). However, no socio-economic development policy has been taken so far for the coastal people who are the extreme victims of the climate change, natural calamities, typhoons and torpedoes. This study has been done on the basis of both primary and secondary sources of data. The authors of this research have exchanged views with the people living in the eastern coastal belt of Bangladesh to know about the socio-economic condition.

Keywords: Eastern coastal zone; Bangladesh government; Chittagong; Cox's bazar; Climate change; Industrialization; Environmental pollution; Sustainable development; Natural disasters; Policy implication.

Resumo

A Zona Costeira é uma área onde oceano, terra e meio ambiente interagem entre si; portanto, é de natureza viva e variada. As zonas costeiras de Bangladesh estão sendo frequentemente atacadas por ciclones, tempestades e elevação do nível do mar, que afetaram terrivelmente esta zona costeira de baixa altitude. Os pré-requisitos multifacetados da zona costeira exigem abordagens integradas com tudo incluído para gerir. Este estudo tem como objetivo identificar os antecedentes da problemática socioeconômica da população da zona costeira em particular na faixa oriental. Ele também discute os vários problemas ao longo das áreas costeiras, e a racionalidade da governança e gestão costeira para o desenvolvimento sustentável, estrutura para resolver as questões costeiras na zona oriental, mudanças climáticas e impactos ambientais, e recomendações de políticas para o desenvolvimento e gestão costeira, de modo a para adaptar a vulnerabilidade às mudanças climáticas (Ahmad, 2019). No entanto, nenhuma política de desenvolvimento socioeconômico foi adotada até agora para as populações costeiras, vítimas extremas das mudanças climáticas, calamidades naturais, tufões e torpedos. Este estudo foi feito com base em fontes primárias e secundárias de dados. Os autores desta pesquisa trocaram opiniões com as pessoas que vivem na faixa costeira oriental de Bangladesh para saber sobre a condição socioeconômica.

Palavras-chave: Zona costeira oriental; Governo de Bangladesh; Chittagong; Bazar de Cox; Alterações Climáticas; Industrialização; Poluição ambiental; Desenvolvimento sustentável; Desastres naturais; Implicação da política.

Resumen

La zona costera es un área donde el océano, la tierra y el medio ambiente interactúan entre sí; por lo tanto, es de naturaleza viva y variada. Las zonas costeras de Bangladesh están siendo atacadas con frecuencia por ciclones, marejadas ciclónicas, aumento del nivel del mar, que han afectado terriblemente a esta zona costera baja. La zona costera multifacética requiere enfoques integrados de gestión que incluyan todo. Este estudio tiene como objetivo identificar los antecedentes de los problemas socioeconómicos de la gente de la zona costera, particularmente en el cinturón oriental. También se analizan los diversos problemas a lo largo de las áreas costeras, y la racionalidad de la gobernanza y gestión costeras para el desarrollo sostenible, el marco para resolver los problemas costeros en la zona oriental, el cambio climático y los impactos ambientales, y recomendaciones de políticas para el desarrollo y la gestión costera de manera que para adaptar la vulnerabilidad al cambio climático (Ahmad, 2019). Sin embargo, hasta ahora no se ha adoptado ninguna política de desarrollo socioeconómico para la población costera, que son las víctimas extremas del cambio climático, las calamidades naturales, los tifones y los torpedos. Este estudio se ha realizado sobre la base de fuentes de datos tanto primarias como secundarias. Los autores de esta investigación han intercambiado puntos de vista con las personas que viven en el cinturón costero oriental de Bangladesh para conocer la situación socioeconómica.

Palabras clave: Zona costera oriental; Gobierno de Bangladesh; Chittagong; Bazar de Cox; Cambio climático; Industrialización; Contaminación ambiental; Desarrollo sostenible; Desastres naturales; Implicación de política.

1. Introduction

Coastal zone can be a great source of trade and investment and establishment of land and river ports. Coastal Zone of Bangladesh needs an integrated management strategy to ensure a common collaboration among the different coastal communities, policy, and socio-economic opportunities to attain viable development in the coastal areas. Coastal zone has enormous development opportunities, through which poverty can be reduced in the area, and

contribute to the local and national economic development in Bangladesh. The zone has diversity of natural resources, and tourism potential, and, of course, it has ample scope to contribute to the GDP. Bangladesh already has taken ocean governance initiative (Ahmad, 2019). Presently coastal zone is not being seriously taken into consideration by the stakeholders including the public enterprises as a tool of revenue collection, tourist attractions and establishment of economic zones.

The Coastal zones of Bangladesh are hydrological which is covered by the Ganges, Brahmaputra and Meghna (GBM) river scheme, and the Bay of Bengal. The coastal area has covered an area of 32% of the country. Around 35 million people, who represent 29% of the population, live in the coastal area. Coastal areas consist of 19 districts that are, Jessore, Gopalganj, Narail, Shariatpur, Chandpur, Khulna, Satkhira, Bagerhat, Pirozpur, Jhalakati, Barguna, Barisal, Patuakhali, Bhola, Lakshmipur, Noakhali, Feni, Chittagong, and Cox's Bazar (Abu, 2003 & Ahmad, 2019). Depending on geographic features, coastal zone of Bangladesh consists of three parts: (a) The eastern zone, (b) The central zone, (c) The western zone. The western region, which is best known as Ganges tidal plain, it covers the semi-active delta, and is intersected by various canals and streams.

The central region is the most active, and coastal land erosion is a continuous incident there for the frequent floods, typhoons, heavy rains and tornedoes. Meghna River's bay lies here in this belt. The eastern coastal area is surrounded by mountainous area, and it is more stable (Thomas, 1992 & Ahmad, 2019). The coastline is 710 kilometers long which encompasses various agricultural, fishing, and other economic activities, including mangroves (world largest mangrove forest covers 6,017 km²).

Coastal areas in Bangladesh comprise of estuaries, sea grass, about 70 islands, uninhabited small islands, beaches, a peninsula, rural settlements, urban and industrial areas, and ports (Hossain, 2001; Iftekhar, 2006, & Ahmad, 2019). A huge number of the coastal residents are poor, and these populations are vulnerable to natural calamities and man-made industrial hazards. Climate change driven natural problems are, storm surge, coastal inundation, sea level rise, cyclone, salinity intrusion and land erosion (Iftekhar, 2006; Hossain, 2001 & Ahmad, 2019).

The coastal areas of Bangladesh are suffering from a wide range of climate change hazards and anthropogenic problems. So, good and sustainable management for this coastal area is very crucial. Besides, environmental protection, socio-economic and political rights of the coastal people should be ensured through the different development policy programs by

the different stakeholders, particularly the government. In the 1960s, the government took the coastal management and development programs for the coastal areas through the construction of coastal embankments, building of coastal greenbelt, and land reclamation, and delta development (Iftekhhar, 2006).

The coastal areas are mostly rich in bio-diversity. Western part is enclosed by the world largest mangrove forestry. The Sundarbans is very rich in varied fish, fauna of 120 species, and over 270 species of birds, which provide incomes to around 3,00,000 people in the different seasons of the year working in the different small-business professions. Some of the coastal areas are covered by sea grass with different species.

A total of 165 species of seaweed belonging to 77 types have been reported (Figure 2). Although, Bangladesh is responsible for emitting less than 0.1% of global greenhouse gas emissions, it is now one of the victims of global warming and climate change (Climate Change and Bangladesh, 2001& Ahmad, 2019). Climate change is posing a serious threat to the sustainable development in Bangladesh including the coastal areas. A 1 m increase in the sea level would sink 18% of the total land areas in Bangladesh (Minar, 2013 & Ahmad, 2019).

A research shows that extremely waterlogged region (depth above 100 cm, time period of which is more than 9 months) would surge by 29% (from the base year 2000) for 88 cm SLR (CEGIS, 2013, & Ahmad, 2019). The entire salinity affected land in Bangladesh was 83.3 million hectares in 1973, which was augmented up to 102 million hectares in 2000, and the amount has risen to 105.6 million hectares in 2009, and will continue to increase (Mahmuduzzaman, 2014, & Ahmad, 2019). With 50% of the land less than 8 meters above the sea level, and a coastline of some 600 kilometers, where coastal flooding is a most probable (Bangladesh Coastal Flooding Forecasts Save Lives, Flood List, 2017). Bangladesh is mainly susceptible to steamy typhoons with around 718,000 deaths in the past 50 years (Ubydul, 2011 & Ahmad, 2019).

The western coastal zone is particularly vulnerable to surge flooding due to its low-lying land and very poor defense against surge waves (Karim, 2008). A GIS based study shows that, a total of 1183 km² of land has been eroded between 1995 and 2005, and 1194 km² from 2005 to 2015 around the central part of Bangladesh coastal zone. Most important corrosions occurred in the areas of Meghna bay, and beside the coasts of main isles such as the eastern coastal area of Bhola, the northern coastal area of Hatiya, and the south-western coastal area of Sandwip (Ahmed, 2018).

The upcoming climate-change vulnerability will be significantly greater than the present condition (Uddin, 2018 & Ahmad, 2019). The climate-change impacts will be greater in the coastal region of Bangladesh for the geographic location, dense population, and high poverty. The most vulnerable areas of climate change are: the central and western part (Figure 3), because western part mostly covered by Sundarbans, but, it is covered with low lying land areas, and the central part is comparatively dynamic.

Bangladesh is one of the important coastal countries in the world. The major marine and coastal habitats of Bangladesh are: Coral Reefs, Sea Grass Beds, Flood plain, Sandy Beaches, Inter-tidal and Sub-tidal wetlands, Mudflats, Lagoons, Salt Marshes, Estuaries, Peninsula, Mangrove forest like Sundarbans, and St. Martin Island, etc. All of these resources are very important for national economic development and social prosperities (Mangroves for the Future, 2018). Moreover, there are huge human pressures working on these resources, and it has a big impact on the state and sustainability.

The study will discuss and explain how human behaviors within the system and external driving forces have affected the system; and will identify responses or interventions that have led to the changes in coastal and marine assets which are important to the people and decision-makers in the eastern coastal zone of Bangladesh. The DPSIR (Drivers-Pressures-State-Impact-Response) method is applied for organizing a justified analysis.

2. Materials and Methods

This study was carried out based on secondary information and data. However, some primary data have been used in carrying out this study. To collect primary data, intensive interviews were carried out on the coastal demography, coastal development policies, coastal management strategy, and marine resources. Necessary data on coastal zones related to anthropogenic impacts, and agriculture related statistics in the context of Bangladesh were collected. The secondary data and graphics were also collected from the original research works. For data analysis, the “content analysis” method has been used. This method was used as research tool for interpreting and coding textual materials. Secondary sources of data such as archival-documents, books, research monographs, video documentaries, news of electronic media, and graphics on the eastern coastal region of Bangladesh have been collected in carrying out this study.

3. Objective of the Study

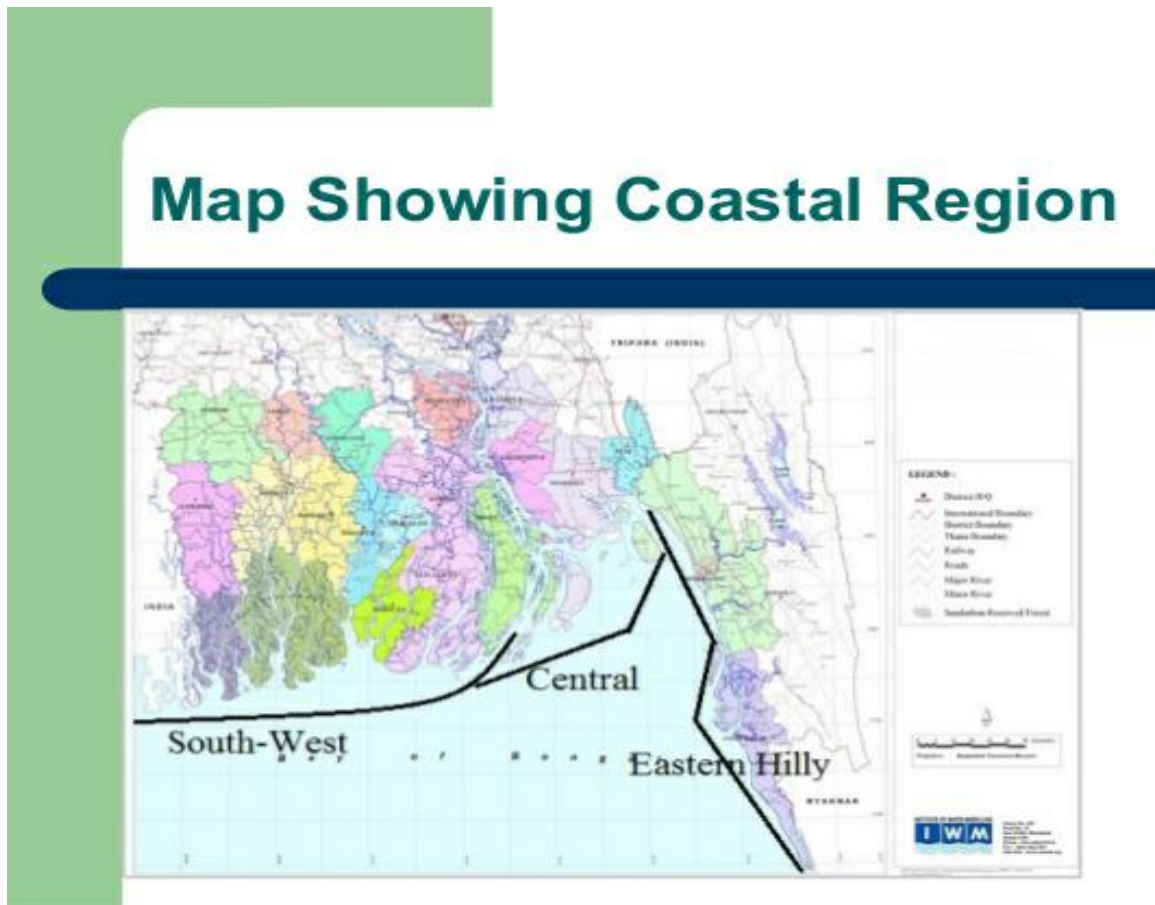
This study has been carried out for these reasons: To support an enabling socio-economic and political development plan to be formulated and implemented; to create a common, inclusive, and documented knowledge base for water, land, and related natural resources, as well as spatial planning in the Bangladesh's delta with the particular emphasis on water, land, agriculture, public health, environment, disaster management, food security, economic growth, and spatial and ecological development. And, to provide suggestions to use the local tacit-knowledge with foreign technology to undertake integrated plan of action and building infrastructure with the main stakeholders for sustainable development with environmental protection along the coastal belt.

Development of a Delta Framework and preparing of a draft Act encompassing necessary reforms for the current institutional framework, as well as the involvement of the governmental organizations, is very important. Bangladesh needs to prepare formulating the Bangladesh Delta Plan (BDP 2100), and implement the plan in an integrated, targeted, inclusive, broadly supported, and transparent manner (Ahmad, 2019).

4. Socio-economic status of the East Coast Region of Bangladesh

The Eastern coastal region of Bangladesh is widely known as Chittagong. From the great Feni River in Bador Mokam (southern tip of the continent) along Chittagong is the eastern coastal zone of Bangladesh. The eastern coast is systematic and constant, and is sheltered on the shores of mud and sand. An adjoining stretch of sand (sandy beach) extends from Teknaf (Myanmar border) to Badar Mokam, and it forms the longest beaches of about 145 km. There are many small rivers in Ukhia, and Teknaf coastal belt, and the Chakoria mangrove forests are also located in the eastern region. Karnaphuly, Mathamuhuri, Sangu, and Naf rivers play a significant role in the coastal ecology. As most of the people of this area are poor, and most of them are dependent on fishing at the sea; driving boat, agricultural activities, and aquaculture etc. There are also some impacts of eco-tourism and mangroves on the local economy (Ahasan, 2013).

Figure 1: Coastal Region of Bangladesh.

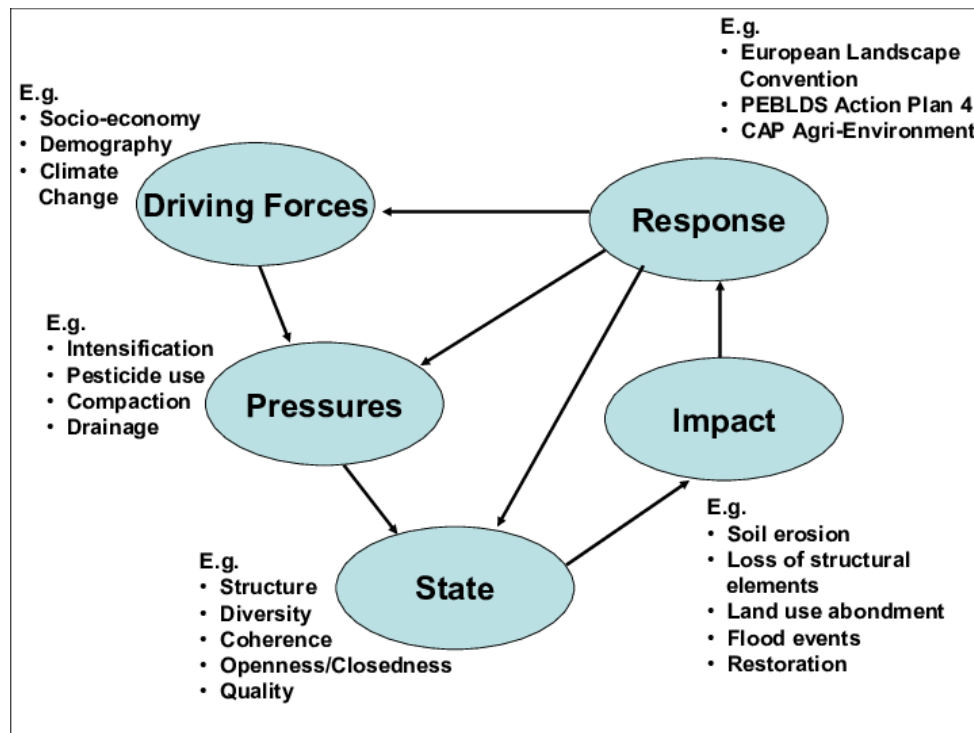


Source: Map Showing Coastal Region, (2018).

The above map shows that the eastern coastal zone is a long belt which stretches from Feni district to Teknaf sub-district. This coastal region is very rich in natural resources, and it requires huge infrastructural development for industrialization, special economic zones, expansion of tourism and overall economic development. Also this coastal area is called the Bay of Bengal which is connected with the Indian Ocean; and there can be created huge possibilities of trade and investment through establishment of some deep sea ports. Therefore, the infrastructural establishments in the south eastern coastal region, particularly in the South East Cox's bazar are of paramount importance for geostrategic and economic reasons.

5. The DPSIR Framework

Figure 2: An Example of the DPSIR Framework.



Source: Wascher, (2004).

According to (Kristensen, 2004) DPSIR framework, there is a chain of causal relationship ranging from "driving forces" (economic sectors, human activities) to "pressure" (emissions, waste) to "states" (physical, chemical and biological) and "impact" on ecosystems, human health and functions, eventually leading to political "responses" (prioritization, objectives, indicators). The description of the causal chain of driving forces for the effects and reactions is a complex task and tends to be taking into account the relationship of the pressure of state. The DPSIR framework is used in this study to analyze coastal and marine resources on the Eastern Coastal Area of Bangladesh. We think that without political decision, development plan and policy implementation is not possible. Therefore, the DPSIR framework is suitable to explain the all elements related to the climate change, coastal development and management through a systematic way.

6. DPSIR Framework for the Eastern Coastal Zone of Bangladesh

To analyze major coastal and marine resources of the Eastern Coastal Area of Bangladesh, the study has been categorized according to 5 categories which are 1. Drivers; 2. Pressures; 3. State; 4. Impact; 5. Response that means the DPSIR framework.

6.1 Drivers

The main drivers of the eastern coastal zone are local poor community, political leaders, businessmen and industrialists. Now, we will discuss in details about their role in the coastal areas, and how they have affected on the marine and coastal ecosystem.

6.1.1 Local Poor Community

The local community includes tribal ethnic minorities, people living in the slum area, local fisherman, boatmen, labors and fishermen who depend on the coastal and marine ecosystem at the eastern coastal zone. Most of these people are very poor. Their wages are low, and employment rate is, therefore, not satisfactory for the seasonality of the agricultural activities. According to the BBS data, the average wage rate in the rural Bangladesh has long been below U.S 1 dollar for a long time. But, the average wage rate is higher in the coastal zone than that of the national average. In the coastal zone, the rate of agricultural activities in Chittagong is higher compared to the other coastal zones. In the other districts, wages are below the national average (Ahasan, 2013). Therefore, the government of Bangladesh should formulate public policy so as to ensure the proper training for the people living in the coastal zone to make them skilled for the job markets.

6.1.2 Political Leaders

Political leaders have a great impression and power in every sector in Bangladesh. Even, they are the decision makers for the communities for development. They are directly involved in the policy formulation and implementation. These political persons are: Union Parishad Members and Chairman, Upzaila Parishad Chairman and members, District Council Chairman and members, and Local Members of the Parliament. These political leaders are

elected by the local communities, and most of them are involved with different political parties (The local government system in Bangladesh, 2018). Thus, the political leaders, irrespective of their political affiliation, have an ample scope to do something for the betterment of the local poor communities, including for the poor people of the different coastal zones in Bangladesh.

6.1.3 Businessman

Chittagong is a commercial capital of Bangladesh. There is a port in Chittagong which is the largest port in Bangladesh. For that reason, many businessmen are involved in doing business there. Moreover, there are other businessmen who are involved in fishing business, eco-tourism, shipping, fish processing etc. Most of the businessmen in this area are very rich. The number of new businessmen is also increasing day by day (Chittagong Port Authority, 2018). In this regard, the businessmen can do a lot of things such as providing them with employment opportunities, and partnership in the different business, for the poor people of the coastal zone in the Chittagong region. There are a huge number of business persons in Chittagong city who can come ahead to support the marginal people of the coastal zone by providing them with the different income generating task. It is also important to emphasize here that, the business community is a crucial one to make a country socio-economically prosperous.

6.1.4 Industrialists

Most of the Ship breaking industries are situated in the eastern coastal zone. Even, there are many industries in greater Chittagong region. For that reason, many industrialists are involved in the shipping business, and some of them are involved in ship breaking industries, which are now globally reputed. They have a big control on the Bay of Bengal area's economic and social activities like employment, and community development etc. (Ship Breaking Industry in Bangladesh, 2018). These industrialists can play a pivotal role in the socio-economic development of Bangladesh including the infrastructural development along the coastal zones, through which huge employment opportunities can be created for the poor people of the coastal zone. Most of the still re-rolling mills, cement factories, and a number of garment industries are situated in the Chittagong region. The businesspersons involved in

these trades can come ahead to promote economic growth in the country. They also play a pivotal role in the socio-economic development of the poor communities of the coastal zones.

6.2 Pressures

There are many pressures in the study area including industrialization, rapid urbanization, and tourism, ship breaking industries, water pollution and fishing which are described below:

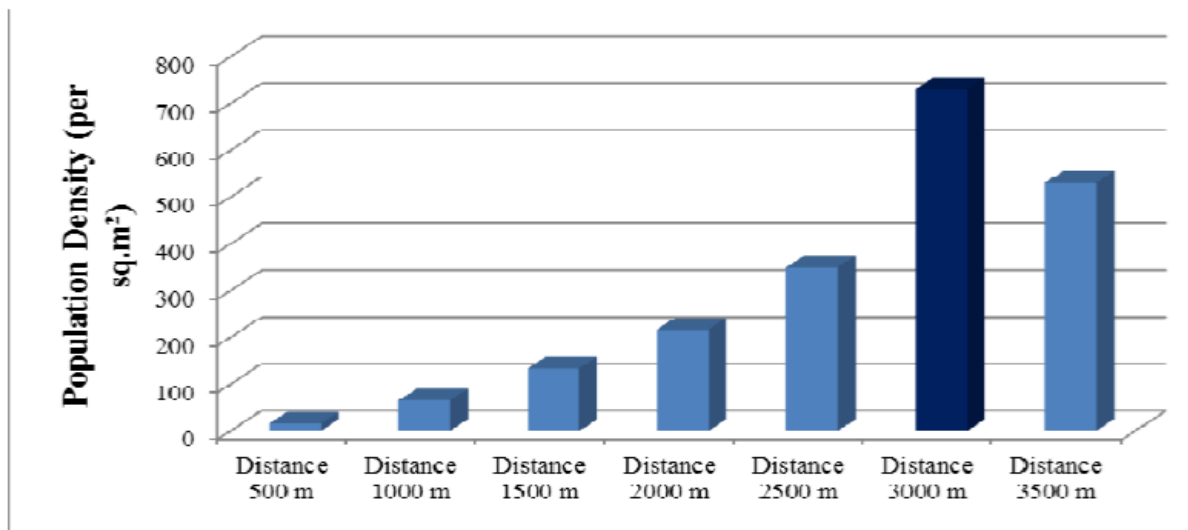
6.2.1 Industrialization

There are many industries in Chittagong. The coastal zones are normally considered as a perfect place for the expansion of marine and coastal resource-based industries such as salt production, shrimp hatchery, and as centers for the processing of sea fishes and other fishes. Moreover, due to having better shipping and transportation infrastructure, the region is also considered as a perfect place for other important industries such as ship breaking industry, steel industry, ready-made garments' industries, and cement industries etc. (Islam, 2016). However, industrialization is very good for rapid economic development and modernization. This industrialization can play an important role in the infrastructural development along the coastal zones in Bangladesh for tourism, trade and investment and construction of marine drive, by which the economy of the country will be rapidly grown up.

6.2.2 Rapid Urbanization

In the eastern coastal area of Bangladesh, there is second largest city, which is called Chittagong. Urbanization is increasing here day by day. The density in Chittagong is 142 persons per hector. The following figure shows urban growth factor in Chittagong city.

Figure 3: Population Density of Chittagong Urban Area.



Source: Samad, (2016).

The reasons of urban population growth in Chittagong are rapid industrialization, and higher employment opportunities, and business friendly atmosphere. There are also some other reasons which are particularly accountable for the urban population growth. It is also true that the birth rate is also high in Bangladesh including Chittagong (Samad, 2016). The populations' growth should be considered as the potential human resources for the country. We should remember that Singapore is a small country in geographic size, but developed in the economy with huge population. And, Singapore is one of the top richest countries in the World, because of human resource development, trade and investment, quality education, and connectivity and ports' facilities.

6.2.3 Tourism

Still now, tourism is a developing sector in Bangladesh. But, it is a potential sector in Bangladesh. There are a number of areas for tourist attraction in the eastern coastal area of Bangladesh. For example, Cox's Bazar where the longest sea beach of the world is situated. The coral island, St. Martin, the only hilly island Moheshkhali, and sandy beaches etc. All of these places attract both local and foreign tourists for the unique seascapes and landscapes. It also gives us fresh water and air with an opportunity to observe wildlife both in sea and land (Islam, 2016). It is high time to develop the coastal zone of Cox's Bazar bordering with the

Bay of Bengal, from Cox's Bazar to Teknaf. And the construction of a road along the Naf River bordering Myanmar, from Ukhia to Teknaf, is very crucial for connectivity, trade and investments, border security, building of immigration points, people to people contacts. Construction of a road along the Naf River can help improve easy transports between Ukhia and Teknaf; and this road will connect the region with the Bay of Bengal at the Teknaf point. Building a four lane high way from Ukhia to Teknaf along the Naf River is very important, because Ukhia and Tekanf have direct border with Myanmar, it is a connecting point for South East Asia, China, North East India, and the Bay of Bengal. Geopolitically, and geoeconomically, Ukhia and Teknaf is undoubtedly a significant region for Bangladesh's interests.

6.2.4 Fishing

Fishing is an important sector in the coastal zones which is a vital source of income for the eastern coastal zone's people of Bangladesh. There are many people in this area who depend on their livelihood on fishing. Moreover, Karnaphuly, Bakhkhali, Matamuhuri and Naf Rivers are the main estuaries' system in Bangladesh which is situated in this area. Also, marine resources of this region significantly contribute to the local and national economy as well as provide help to the socio-economic welfare of the poor communities of the eastern coastal zone of Bangladesh (Ahasan, 2013). Therefore, good management and reforms of these rivers are very important.

6.3 State

There are some direct results for the various pressures on the coastal eco-system. These can be categorized as pollution, deforestation, erosion of coastal land, illegal fishing sea piracy, and climate change etc.

6.3.1 Pollution

There are a number of industries which are situated in the eastern coastal area of Bangladesh, of which: pulp and paper, jute, paper, fertilizer, textiles, rubber, plastic, food and beverages, tannery, sugar, pharmaceuticals, tobacco, ship breaking, and distilleries are

remarkable. However, the wastages of these industries are mainly responsible for coastal pollution in Bangladesh. In fact, most of these industries are situated in the Chittagong coastal district. A study has found that around 600 industries were established in and around the Karnaphuly and Bakkhali River in Chittagong. This area is primarily responsible for the river and water pollution through expulsion of vast amount of both liquid and solid waste which contains toxic materials. Also, a number of studies have recognized high level of both marine and fresh water pollution due to inappropriate management of manufacturing waste. Moreover, high level of chemical absorption of Karnaphuly River and the Bay of Bengal of Chittagong coastal area is an alarming issue (Bangladesh National Programme of Action, 2015). Therefore, the government can adopt coastal policy to collect the wastages of the different industries, which, later can be transformed into the electricity and other materials through incineration plantation like the developed countries including Japan. Industry owners should not be allowed to drop waste at the sea to stop River and sea pollution.

6.3.2 Deforestation

Day by day, depletion of forest resources is increasing in the area, because of the population growth and demand of socio economic activities. It is also a serious concern in the eastern coastal area of Bangladesh. There are some reasons for deforestation such as elimination of forest products for fuel, salt production, haphazard fishing activities and human settlement. In the region, Sundarban of Chakoria has totally been destructed. The coastal mangroves of Sitakundu which are also located in this area have also been degraded (Bangladesh National Programme of Action, 2015). The authorities should monitor the deforestation, and should take necessary steps to stop the ongoing depletion of forest resources for the Rohingya influx in Cox's Bazar.

6.3.3 Erosion of Coast

Land erosion is a common natural phenomenon in all coastal areas of Bangladesh. In the last two centuries, major changes have occurred on the coastal belts due to soil erosion associated with land-grabbing. Strong tidal currents and storm waves associated with the rising sea levels can lead to coastal erosion and flooding. Swells can cause coastal erosion, depending on the altitude and frequency of the sea. Coastal erosion usually occurs in

Chittagong and Cox' Bazar during the monsoon season; but, it is stronger during the southwest monsoon or any episodic event such as storm surges or ocean waves hit the coast (Bangladesh National Programme of Action, 2015). Natural disaster management is good in Bangladesh, but, requires further improvement in the management; particularly the country can seek necessary advice from Japan International Cooperation Agency (JICA) for transferring disaster management technology to Bangladesh.

6.3.4 Illegal Fishing and Sea-piracy

Illegal fishing and sea piracy is a common issue in the Bay of Bengal near Chittagong and Cox's Bazar area. Many vessels from India, Myanmar, and Thailand enter Bangladesh marine area; and they become involved in illegal fishing and sea piracy. These illegal foreign fishermen attacked physically on Bangladesh's fishermen, and sometimes, used to snatch all the belongings from them. It's a big threat for the maritime security of Bangladesh. Due to piracy, fishermen also lose their valuable lives (Islam, 2016). The government of Bangladesh should take necessary steps to combat the sea piracy in the coastal areas and the Bay of Bengal.

6.3.5 Climate Change

As a deltaic coastal country, Bangladesh is one of the most vulnerable countries of the world in terms of the climate change. The country has already experienced several climate change impacts, including increased cyclones, frequent floods, erosion, rising groundwater, saltwater intrusion, and the biological effects. Particularly, the threatened coastal areas are: mangroves, tidal and coastal plains, sandy beaches, coastal wetlands, estuaries and coral reefs. These bio-geophysical properties will have a significant impact on ecosystems and potentially affect socioeconomic systems in the all coastal zones of Bangladesh (Sharmin, 2013).

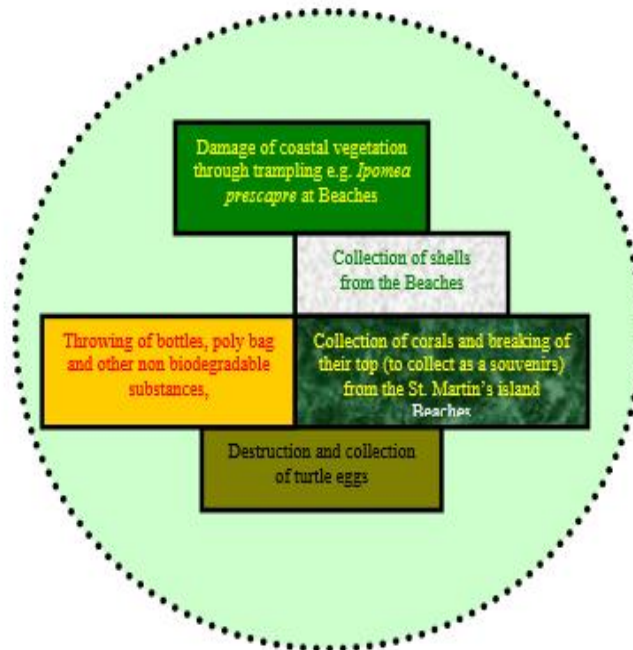
6.4 Impact

There are a lot of impacts in the eastern coastal zone of Bangladesh. Mostly, the businessmen and industrialists have been involved in the water and air pollution for their economic benefits which has a negative effect on environment. Moreover, local communities

are compelled to work in these industries for subsistence. As ship breaking industry is one of the leading industries in the area, but it has a big impact on the marine and costal resources such as sea pollution, depletion of different fishes and other sea animals. However, according to (Bangladesh National Programme of Action, 2015), the below impacts were found on the eastern coastal zone, marine and coastal resources, and ecosystem:

1. Surface water pollution is increasing which is a major threat to both freshwater and marine ecosystem. It is also a reason for high environmental risk for future generation in the eastern coastal region.
2. Due to overfishing and illegal fishing, fishes and aquatic organisms are being lost day by day. For that reason increasing food and livelihood insecurity are increasing which is a risk for human health of the local community of the coastal zone.
3. Due to increase of the erosion in the coastal zone, the biodiversity of that area are decreasing and physical environment is threatened there.
4. Decrease in agricultural productivity, because of the loss of land. Moreover, Forest landscape is changed for climate change. So, food security will be a challenge there.
5. Rapid industrialization in the coastal areas is one the reasons for losing arable lands. Also, due to limited space for the growing populations, the arable and forest land will be exploited.
6. Exposure of coastal communities to natural disasters is the reason for losing of human settlement zones and growing floating people in the coastal cities like Chittagong and Cox's Bazar area.
7. Due to the coastal pollution through the tourism activities in the beach like throwing bottles, poly bag, and the harm of coastal flora through trampling are increasing gradually.

Figure 4: How coastal tourism pollutes the coastal and marine environments.



Source: Bangladesh National Programme of Action for Protection of the Coastal and Marine Environment from Land-Based Activities, 2015.

The above figure shows that the coastal areas are polluted through many ways; the government and the pertinent authority should come ahead to take necessary steps to stop the water pollution along the coastal areas including the eastern coastal zone. Without a safe coastal zone, sustainable development is not possible in Bangladesh. Therefore, the government should formulate appropriate and timely policy to protect the coastal eco-system and promote eco-friendly coastal tourism in the eastern coastal zone. Also, environmental protection is equally important to ensure sustainable economic development in the country.

6.5 Response

At present, both government and political leaders of Bangladesh are involved in reducing the impact in the study area. There are a lot of ministries in Bangladesh, such as Ministry of Shipping, Ministry of Environment and Forest, Ministry of Fisheries and Livestock which are responsible for the protection of environmental sustainability. Even local government where political leaders are involved in decision making, they are also worried

about the impacts. There are also several laws and acts, policies related to marine and coastal issues like Coastal Zone Policy, National Fisheries Policy, National Environment Policy, and Marine Pollution Ordinance etc. Even there are law enforcing agencies like Executive Magistrate, Police force, and Coast Guard who are responsible to implement these laws and rules. According to (Islam, 2016), the below responses are considered for the coastal and marine resources in the eastern coastal area of Bangladesh:

1. In the last 20 years, there have not been found any specific data on coastal zones and fisheries which are very important for fish production. So, it should be assessed within the Exclusive Economic Zone of Bangladesh by the responsible ministries or organizations.
2. A coastal land use policies should be implemented by the Ministry of Land which is possible with the existing laws and strict enforcement.
3. A proper implementation of marine and eco-tourism plan should be implemented by the Ministry of tourism which should include protecting biodiversity and heritage with special attention to the coastal region.
4. There are several ministries in Bangladesh which are responsible for the plan of action for Climate change. However, effective and adaptive conservation approach plan and action are needed for protecting coastal and marine resources.
5. Since the government makes a guideline to implement SDGs in Bangladesh, so marine and coastal areas should be given particular emphasis in those policies. Also, the government has declared Marine Protected Areas in the Bay of Bengal which is a great initiative.
6. Local political leaders may recommend directly to the relevant minister or parliament regarding the present situation.

7. Conclusion

From the above discussion, we can say that the eastern coastal region of Bangladesh is a diversified and vulnerable area. So, as per the impact, both local people and authority like the political leaders and bureaucrats can play a vital role to develop a better socio-economic

zone in Bangladesh, as this area is a place of high possibility for economic development in Bangladesh. Coastal zone management is very challenging, because it must address all related issues regarding the all socioeconomic and natural issues. Also, it is very important to mention here that coastal zones of Bangladesh, that holds one-third population of Bangladesh, are now living in a numerous challenges.

The output of integrated coastal zone management is not satisfactory in the country. Coastal management approaches depend on the information available on the various aspects of coastal ecosystems, processes, resources, natural hazards and their impacts, and the effective response by the government. Coastal zone management is very essential for implementing sustainable development strategy in Bangladesh. The most important thing is to maintain interlinks among the national level, sub-national level and local community in the different initiatives that could ensure safety, security, and sustainability for the coastal communities. And, Bangladesh government already has taken integrated and holistic project named Delta plan 2100 for sustainable development for the present and in future (Ahmad, 2019). Many observers think that by implementing this plan, Bangladesh would be able to achieve its sustainable development goals.

Also, it is important to mention here that the existing research on the eastern coastal region of Bangladesh is not sufficient for policy formulation and implementation. Considering the geostrategic and economic importance of the eastern coastal zone, the government should concentrate on it, and should come ahead through research and infrastructural development in this region. This region is an important hub for land and sea routes' connectivity, trade and investment, Bay of Bengal Industrial Zone and deep sea ports. The government can collect a huge amount of revenues through the construction of some deep sea ports, connecting China, Northeast India, South Asia, South East Asia, North East Asia, Australia, Middle East, Africa and Europe. The government should also finance the researchers involved in carrying out research on the eastern coastal region and its economic potentials.

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