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Blue Economy and Climate Change: Bangladesh Perspective

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INTRODUCTION

The Blue Economy framework promotes sustainable economic development through the proper utilization and preservation of marine resources. Blue Economy, concept has received worldwide attention in recent years. The Blue Economy stimulates economic growth through the sustainable utilization of ocean resources with technological inputs to improve livelihoods and meet the growing demands for jobs without hampering the health of the ocean ecosystem (Sarker et al., 2018). Blue Economy supports food security, manages and protects the ocean environment, creates new jobs and has diversification to add new resources for energy, drugs, chemicals, food and minerals for human welfare (Ninawe, 2017). In addition, Blue Economy also builds resilience to climate change.

It is estimated that ocean-based businesses contribute more than 500 billion USD to the world's economy (Ocean, 2017). According to the OECD's Ocean Economy Database (OECD, 2016), the economic value of the ocean outputs in 2010 was 1.5 trillion USD, which is equivalent to approximately 2.5% of world's gross economic value. Blue Economy also contributed around 31 million direct full-time jobs in 2010, which is around 1% of the global workforces (OECD, 2016). Oceans contribute about 81.5 MT of global fisheries production annually (FAO, 2016). The marine fisheries sector directly or indirectly supports the livelihood of 8% of the world's population and contributes 230 billion USD to the global economy (Sumaila et al., 2011). The oceans also provide convenient routes of transportation for about 80% of global trades i.e. goods are transported by sea routes (Corbett and Winebrake, 2017). About 161 billion USD revenues come annually from the global marine and coastal tourism (FAO, 2016).

Ocean energy including aquatic bio-fuels and renewable energies could be an important way to meet the world's energy demands. However, this sector is still in its early stage of development. There are a number of new and potentially valuable industrial products derived from the ocean. These include pharmaceuticals, antibiotics, antifreeze and antifouling paints (FAO, 2016). By the mid-century, enough food, jobs, energy, raw materials and economic growth will be required to sustain a likely world population level of between 9 and 10 billion people (OECD, 2016).

Following the recent international verdict on the disputed maritime areas with the neighboring countries India and Myanmar, the coverage of Bangladesh's marine system estimated to 118,813 km^2, with an extended continental shelf about 37,000 km^2 having up to 50 m depth (Figure 1). Like other global coastal communities, ecosystem services from the coastal and marine ecosystem play a vital role in the livelihoods and income of millions of people living in the coastal zone of Bangladesh and beyond (Islam and Shamsuddoha, 2018). Considering the importance of marine ecosystems, the Bangladesh government has recently emphasized on enhancing Blue Growth and achieving sustainable development goals (SDGs), where ocean-based resources will play a key role (Sarker et al., 2018). Several goals of the SDGs, particularly SDG 14 ("Conserve and sustainably use the

oceans, seas and marine resources for sustainable development") are explicitly related to blue growth, while its others SDGs may have implications to blue growth.

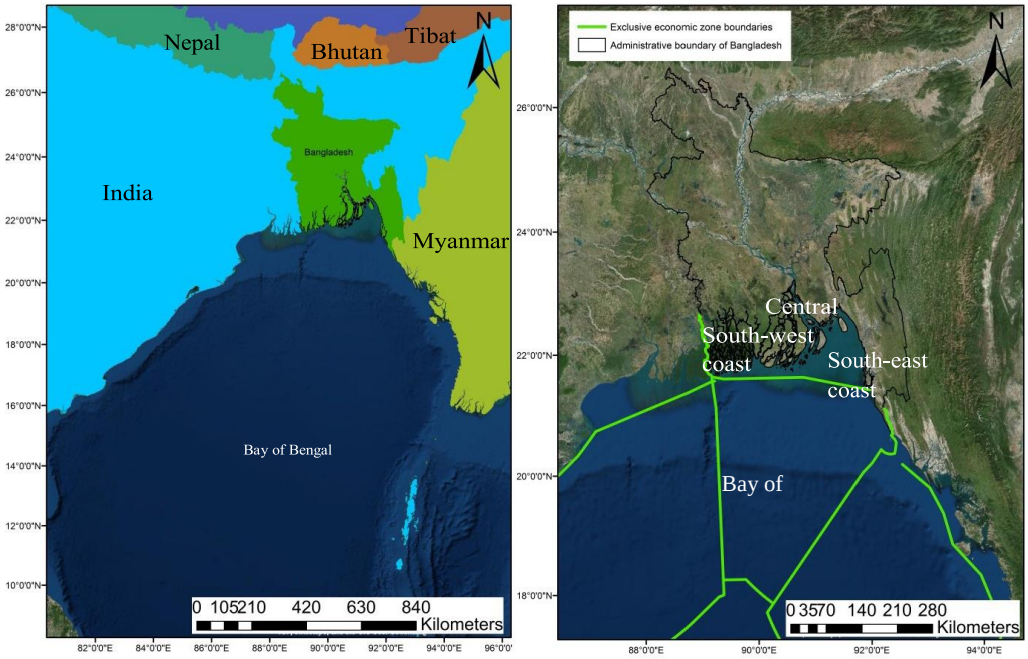

Figure 1 Continental view of the south Asian region (left side) and geographical location of the Bangladesh coast (right side) showing administrative boundary, three coastal zones (i.e. south-west, central and south-east) and Exclusive Economic Zone (EEZ).

Situated as they are in a densely populated developing nation with emerging economies, the coastal and marine ecosystems of Bangladesh face a growing wave changes originated both from natural and anthropogenic sources. Among these changes the impacts of changing climate may cause harm to the wide range of coastal and marine habitats that may limit their services to human wellbeing and overall growth and development. For example, the impacts of climate change are likely to reduce the potential fish production in the Bangladesh exclusive economic zone by 10%. Increased number of climate-induced disasters in the form of extreme hydro- meteorological events such as flood, cyclones, drought, salinity ingress, river bank erosion and increased tidal surge are already observed leading to human causalities, destruction of infrastructure, crop production, natural resources, livelihoods and of course the national economy (Islam, 2011). Therefore, effective and adaptive conservation management plans and actions are required including the identification of especially important marine areas. This background paper aims to find out the potentials for Blue Economy development as well as the impacts of climate change on these potentials. In addition, this background paper offers a strategic planning for obtaining maximum economic return from the marine and coastal ecosystems of Bangladesh taking into the consideration the climate change resilience building.

This study is based on synthesis of both secondary information and primary data. To collect secondary data, an intensive literature reviews related to the coastal and marine

resources and their management issues and constraints emphasizing climate change in Bangladesh context were conducted through the online search. In addition, relevant policy documents and government reports were also collected from the governmental agencies through personal contacts. Primary data were collected through the consultations with stakeholders. The stakeholder consultation method involves consulting with a diverse range of stakeholders who represent a cross section of issues of interest. The issues of interest for this study include marine and coastal resources, their economic values, problems in coastal areas, climate change impacts and the needs to overcome the problems in the coastal areas. Stakeholders included local people, government officials, academics; NGOs officials as well as key informants (e.g. fishers, fish trader, port officials, tour operators etc.).

BLUE ECONOMY POTENTIALS OF BANGLADESH

Economically important coastal and marine resources (Figure 2) are the main components of the Blue Economy for Bangladesh. These resources have also ecological importance. These resources are categorized into living, non-living, renewable resources and trade and commerce. Marine living resources in the maritime zone of Bangladesh include fisheries, mangrove forests, coral ecosystems, plankton, seagrass and seaweeds. About 475 bony fish species belonging to 133 families (Rahman, 1997), 50 cartilaginous fishes, 50 crab species (Quader, 1994), 7 turtles species of 6 genera, 36 shrimp and 5 lobster species, 3 star fish and 11 dolphin species (Quader, 1994) have been reported from the coastal and marine water of Bangladesh. A total 301 species of marine mollusks are reported (Islam, 2003) from the marine water of Bangladesh. About 7 species of squids and 2 species of cuttlefish are reported from the Bay of Bengal (Quddus and Shafi, 1983). Economic returns from these resources are huge, and the total fish landing and total export income from fisheries showed an increasing trend during the present decade in Bangladesh (Figure 3). Total marine fish production accounted 0.6 million MT during 2013-2014 (17% of the total fish production) (DoF, 2016). Over 0.5 million people are directly and indirectly engaged with marine fisheries sector for their livelihood options (DoF, 2013).

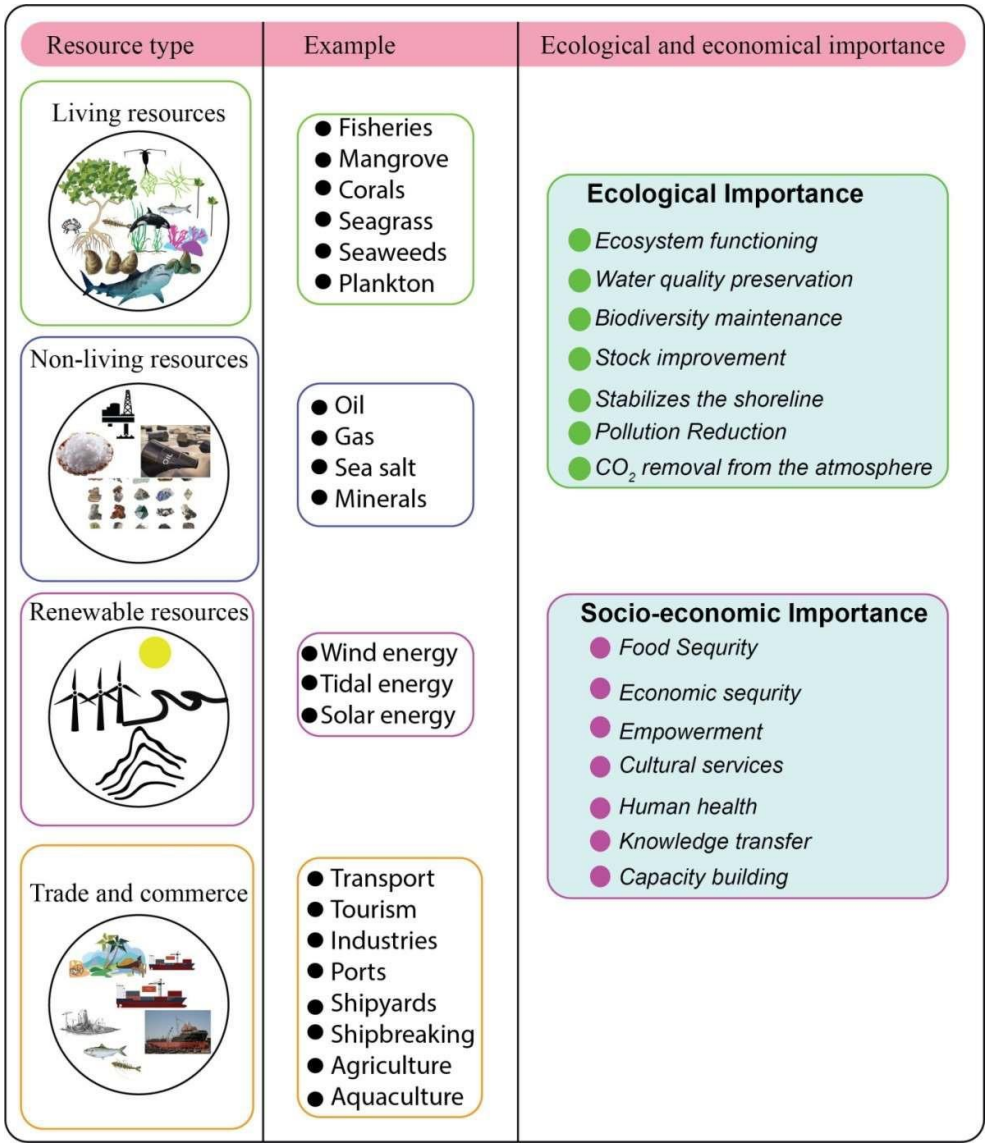

Figure 2 Categories of resources related to Blue Economy with example, and their economic and socio-economic importance.

The coastal region of Bangladesh supports about 530,000 ha of mangrove forests of which 99,000 ha are planted mangrove forests (FAO, 2015). The major continuous natural block of mangrove forest, known as 'the Sunderban' (Figure 4), lies in the south-west coastal zone of Bangladesh and covers an area of about 6, 00,000 ha (Department of Forest, 2017). The entire mangrove forest ecosystem supports 345 plant species of 245 genera which are economically important (Hussain and Acharya, 1994). Data suggest that in recent years, revenues from this forest are comparatively less than the revenues from the 1980s and the 1990s (Figure 3). On average total annual mean revenue from this forest is about 400000 USD where timber, fisheries, honey, wax and tourism contribute 3,500,000, 290,000, 10,000, 3,700 and 267,000 USD respectively.

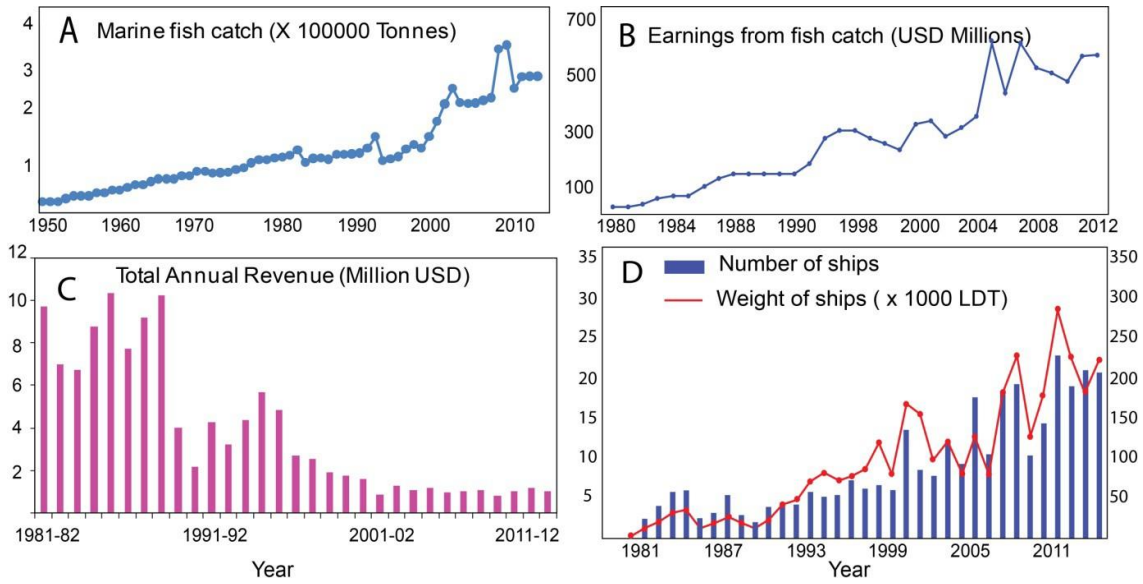

Figure 3 Long-term trends in (A) marine fish catch, (B) income from marine fish catch, (C) total annual revenue from the Sundarbans mangrove forest and (D) number of ship scrapped with light displacement (LDT).

Saint Martin's Island from the south-east coastal zone with a total area of about 7.5 km^2 is the only coral bearing island of Bangladesh (Hossain et al., 2015). Tomascik (1997) recorded 66 coral species from this island. Islam and Aziz (1992) reported that naturally growing seaweeds in Saint Martin's Island represent 20–22 species which have economic value.

About 900,000 ha coastal waters with a depth shallower than 5m is considered suitable habitat for seagrass communities (Chowdhury et al., 2015). Saltmarshes or tidal marshes are distributed over an area of more than 110,000 ha along the low-energy coasts and estuaries of Bangladesh (Hasan et al., 2013). The Encyclopedia of Flora and Fauna of Bangladesh

reported a total of 156 algal species and 50 of them are brown algae, 82 species are red algae, and 26 species are green algae. Around 34 species of phytoplankton are recorded along the coastal regions of Bangladesh (Kamal, 2009), while Mridha (1995) reported 103 species of IUCN (2015) reported 37 zooplankton species from the marine water of Bangladesh.

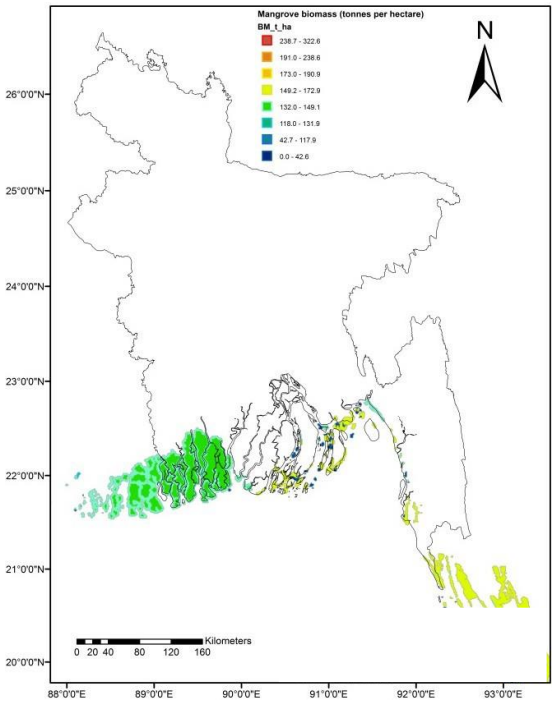

Figure 4 Mangrove biomass distributions in the coastal area of Bangladesh. Data source: Hutchison et al., (2014).

Non-living resources of the Bay of Bengal include crude oil, gas and sea salt. Of 26 gas fields discovered in the country so far, only 2 are located in the offshore areas (Badrul, 2015). About 17 commercially important heavy minerals deposits have been discovered with potentially valuable minerals i.e. Zircon, Rutile, Ilmenite, Leucoxene, Kyanite, Garnet, Magnetite and Monazite (Hossain et al., 2014). After the recent verdicts on the maritime boundary dispute with Myanmar and India in securing maritime territory in the Bay of Bengal, the government of Bangladesh has increased the number of exploratory blocks in the EEZ to 27 (Detsch, 2014). About 6000 ha area is cultivated for sea salt production in the coastal area of Bangladesh. The tourism sector in Bangladesh is now employing over 1 million people and this sector generates a total value of 8.4 million USD.

Bangladesh possesses a distinctive coast with many popular tourist destinations, including one of the world's longest sea beaches (i.e. Cox's Bazar), the largest compact mangrove forest of the world (the Sundarbans) as well as different national parks and islands. Apart from these, commercial use of the marine water of Bangladesh includes international ports development (i.e. Chittagong and Mongla sea port), as well as the newly established Payra seaport. Local transportation, small and large scale industries in the coastal cities, shipbuilding and shipbreaking industries also provide important for economic returns for Bangladesh. The ship breaking industry in Bangladesh is estimated worth an annual turn-over of around 1.5 billion dollars (Figure 3).

CLIMATE CHANGE EXTREME EVENTS AND BLUE ECONOMY

IN BANGLADESH

Climate change will increasingly drive extreme events and the impact of these will stress social fabric in Bangladesh. Disaster-related records of Bangladesh show that the number of cyclones tripled over the last 50 years (Islam 2008). The geographical location of Bangladesh makes the country vulnerable from adverse impact of climate change. Climate change extreme events include (Table 1) warming trend, cyclone, sea level rise, droughts, erosion, tidal surge, saline water intrusion, flood, change in precipitation trend and ocean acidification. International Disaster Database showed that (Figure 5) the frequency of storm, flood and extreme temperature are higher than any other climate related extreme events in Bangladesh from 1990 to 2014. Maximum mortality of human occurred from cyclonic storm. Maximum economic loss occurred due to flood and cyclonic storm and flood contributed most in average annual hazard loss (AAHL). Records of the last 200 years show that at least 70 major cyclones have hit the coastal belt region of our country. At least 12 major tropical cyclones hit the country since 1965, leaving 479,490 people dead. The devastating cyclone of April 1991 caused a damage of around 1.5 billion USD. Cyclone Sidr in 2007 caused damage of 1355 million USD. Cyclone Aila in 2009 losses in Bangladesh estimated at 269 million USD. In Bangladesh, 40% of productive land is projected to be lost in the Southern region of Bangladesh at a 65cm sea level rise by the 2080s (Curry, 2013). About 20 million people in the coastal areas of Bangladesh are already affected by saline water intrusion. This created the scarcity of pure drinking water supply (Rasheed et al., 2016). Approximately 1 million hectares of land in southern in coastal areas of Bangladesh are at risk from saline water intrusion (Baten et al., 2015).

Extreme weather events associated with climate change are also making the coastal and marine resources vulnerable which may hamper the smooth Blue Economy development in Bangladesh. For example, rising temperatures can directly affect the metabolism, life cycle, and behaviour of marine species. This may also lead to coral bleaching, biodiversity loss and breakdown the marine food chain. Cyclone causes loss of coastal resources, degrade coastal habitats, loss of infrastructure facilities. Sea level rise may reduce the photosynthesis of offshore plants and algae as well change the mangrove ecosystem functioning. This will lead to reduction in primary production and ultimately will affect the fisheries. The largest mangrove forest in the world, The Sundarbans, could face severe impacts in the coming years due to increasing salinity and rising sea level. Erosion can cause clogging of air bladder of fish, mortality of the species, loss of coastal resources, degrade coastal habitats, loss of infrastructure facilities. Saline water intrusion and flood may lead to crop damage in the coastal area as well as shift in species habitats. Similar to warming, ocean acidification leads to coral bleaching, biodiversity loss, species migration, biodiversity loss, altered species life style and disruption in marine food chain. Thus, it is a prime need to build marine ecosystem's resilience to climate change to get the maximum benefits from ocean. Initiatives like Mangrove plantation and restoration, sea grass, salt marsh and mussel bed conservation, coral reef protection and oyster reef development can

build resilience to climate change. Moreover, these initiatives will also give economic returns.

Table 1 Climate change extreme events in Bangladesh with their impacts on marine resources and options for resilience building to climate change and enhancing Blue Economy.

Climate change events	Impacts on marine resources	Options for resilience building to climate change and enhancing Blue Economy
Warming	Coral belching, species migration, biodiversity loss, altered species life style, disruption in marine food chain.	Mangrove plantation and restoration, sea grass, salt marsh and mussel bed conservation, coral reef protection and oyster reef development
Cyclone	Loss of coastal resources, degrade coastal habitats, loss of infrastructure facilities.	
Sea level rise	Reduction in photosynthesis, disruption in mangrove ecosystem.	
Droughts	Crop loss	Plantation and crop insurance
Erosion	Clogging of air bladder of fish, mortality of the species, loss of coastal resources, degrade coastal habitats, loss of infrastructure facilities.	Mangrove plantation and restoration, sea grass, salt marsh and mussel bed conservation, coral reef protection and oyster reef development.
Tidal surge	Loss of coastal resources, degrade coastal habitats,	

	loss of infrastructure facilities.	
Saline water intrusion	Crop damage, shift of species habitat	Mangrove plantation and restoration, crop insurance
Flood	Crop damage, loss of infrastructures, loss of habitats.	
Change in precipitation	Crop loss	Plantation and crop insurance
Ocean acidification	Biodiversity loss, species migration, biodiversity loss, altered species life style, disruption in marine food chain.	Mangrove plantation and restoration, Marine spatial planning and marine protected area declaration.

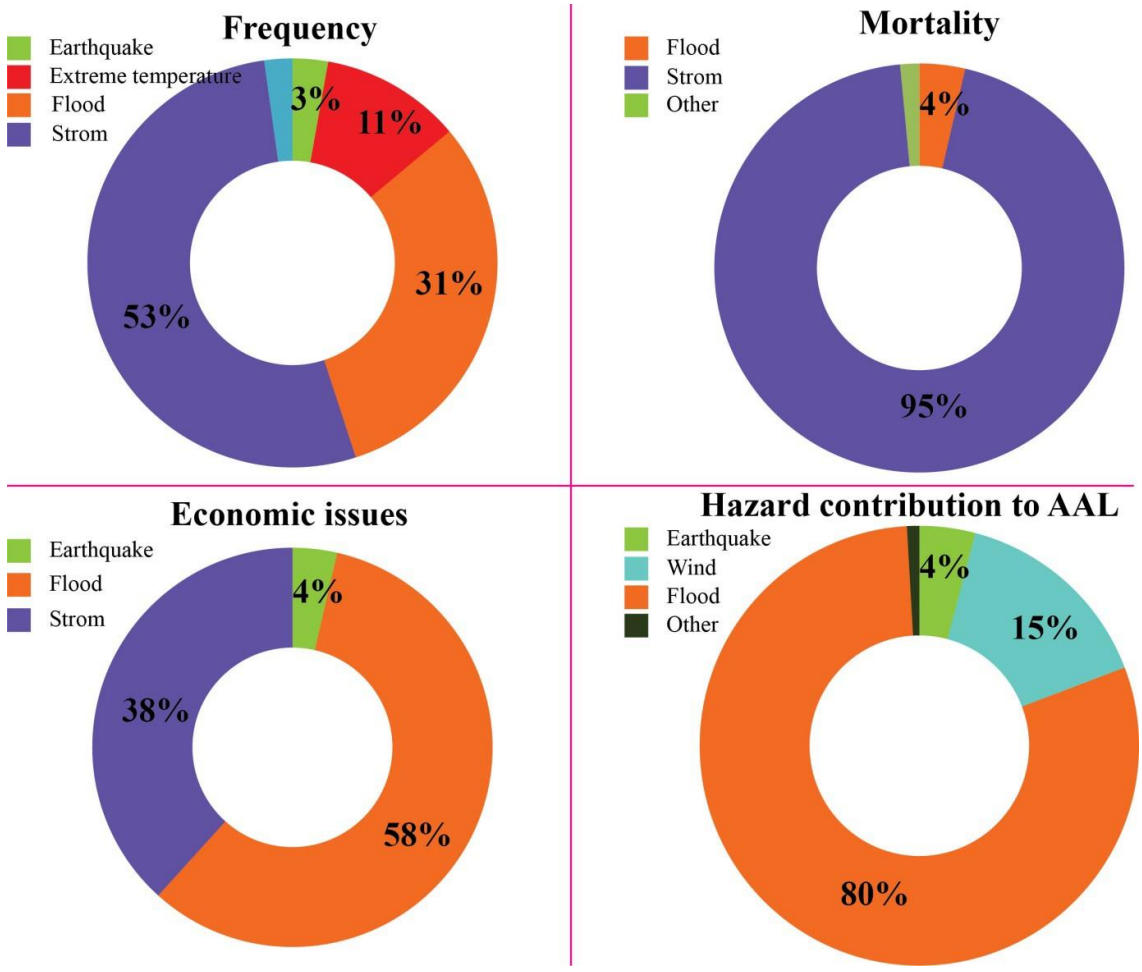

Figure 5 Climate change disasters scenarios in Bangladesh. Top left: disaster frequency, top right: mortality due to disasters, bottom left: economic losses due to different disasters and bottom right: contribution of different hazards to average annual loss (AAL).

WAY TO CLIMATE CHANGE RESILIENT BLUE ECONOMY DEVELOPMENT

Considering the impacts of climate change extreme events, strengthening the Blue Economy is a long-term approach to support sustainable economic development and ensuring the livelihood security of Bangladesh. However, through proper strategies, it is possible to develop climate change resilient Blue Economy practice and make the marine ecosystem as a driver for the national economy of Bangladesh. This background paper offers a strategic framework (Figure 6) for climate change resilient Blue Economy practice in Bangladesh. This framework is a four steps process (i.e. identification of issues, focus on important areas for climate change resilient Blue Economy development, performing activities for achieving the goal and achievement of goal).

Step 1: Identify Issues

The first step is involved with the identification of the issues related to climate change resilient Blue Economy development. Thus, it is important to identify potentials of Blue Economy and climate change extreme events. How climate change extreme events are impacting the Blue Economy potentials as well as how activities related to Blue Economy are impacting the climate are also needed to identify.

Step 2: Prioritize Climate Critical Issues.

Climate change is one of the most serious threats currently facing the Bangladesh, and impacting coastal ecosystems, infrastructure, displacing communities and making the livelihoods vulnerable. Therefore, a special focus on the sectors those could trigger smooth and sustainable Blue Growth in the country is important. These focal areas could be energy efficiency, marine and coastal biodiversity, ecosystem based adaptation, environmental resilience building in the coastal areas, ecosystem restoration, building economic resilience and policy formulation.

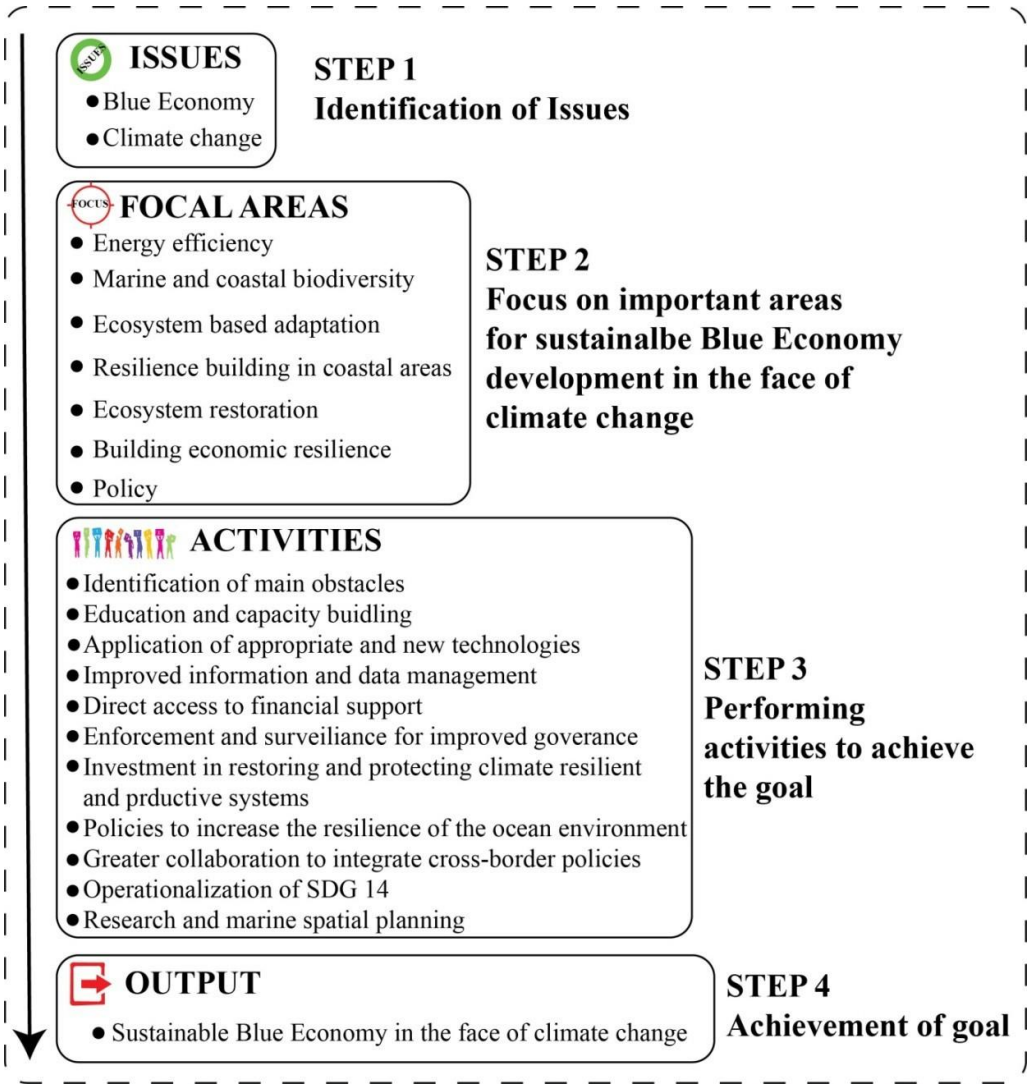

Figure 6 Strategic working procedure to develop climate resilient Blue Economy practice in Bangladesh.

Energy efficiency deployment in key sectors i.e. fishing boats, fish landing sites, coastal recreation facilities and renewable energy applications at small and large scales can contribute in reduction of greenhouse gas emissions. Increasing the biological diversity in marine ecosystems can contribute to the climate change resilience building and can provide ecosystem services. Thus, activities to improve marine and coastal biodiversity and conserve ecosystem health are important.

Some interventions for sustainable Blue Economy development

Cyst Production: Salt production from sea water using solar energy is widely practiced in the Bangladesh coast. When the sea water is concentrated, the salinity of salt pans offers a

suitable environment for the Artemia culture and cyst production. These cysts can be used in the shrimp hatchery.

Floating aquaculture and agriculture: In theory, land crops should have no problem being grown floating at sea, particularly on tranquil waters, as long as they are provided with all their requirements. Potted horticultural crops can be grown avoiding contact with salt water on a variety of floating structures, some of which are used for other mariculture activities. To provide freshwater for irrigation, floating seawater distillation and rainwater harvesting devices can be designed.

Conversion of Existing Island to Model Island: The "Model Island" concept refers the modification of existing islands for maximizing economic returns through diverse utilization strategy of multiple resources with available technological inputs without hampering environmental conditions of islands. For this Moheshkhali Island can be an example. This island has an area of 362 km^2 with a population of 220,000. Salt extraction, agriculture and fisheries are the main activities on the island. This island has mudflats with a small patch of mangrove forest. Mangrove forest offers coastal protection and enhances coastal livelihoods by providing goods and services. In addition, islanders can utilize planted mangrove area for crab fattening in cages and for seaweed culture. Just behind the planted mangrove area islanders can establish oyster and mussel farms. Oyster filters the water and this filtered water can be pumped into a pond and can be used for aquaculture purposes. This way of integration of different resource use and economic activities in the coastal island can meet food demand, provide coastal protection and create new employment opportunities. Wind energy offers a great deal of potential. With an average wind velocity of 7.3 m/s, possible extractable wind energy through wind mills is equivalent to 0.03 kWh from 1 m2 area. Therefore, one family will require around 8900 m2 area to meet their monthly electricity demand of around 250 kWh. In the coastal area of Bangladesh daily sunshine hours varies between 3 to 11 hours. The insolation varies between 3.8 to 6.4 kWh/m2/day with an average of 5 kWh/m^2/day. Therefore, one solar panel in 50 m2 area would be enough for a family to meet the household demand of electricity. In addition, tidal energy (tidal range: 4 - 5 m) and wave energy (wave height: 0.5 - 2.4 m) can be also used for this purpose in the coastal area.

Farming Turtles, Oysters, Seaweed and Non-Target Fishery: In Teknaf and Saint Martin Island of south-east coast of Bangladesh, people usually sell turtle eggs of protected species (2.4 USD/1000 eggs) to the local Rakhaine people. Therefore, to support a typical family (monthly expenditure of 180 USD) in the coastal village one need to sell 7500 turtle eggs. In the same area, oyster meat and shells are sold at 180 USD/kg and 0.05 USD/shell, respectively. If commercial production of oyster meat is introduced properly, one typical family will need to sell 125 kg oyster meat per month to maintain their monthly expenditure. Seaweed cultivation costs 2.4 USD/m^2 and cultivated sea weed can be sold at 7.8 USD/m^2, thus with a net profit of 5.4 USD/m^2. Therefore, only 34 m^2 sea weed cultivable area will be required to meet the monthly expenditure of a typical family. Non- conventional marine fish species (for example, goby fish) can be used for poultry feed production. For example, prawn feed can be produced dried goby fish can be sold at 0.24 –0.25 USD/kg.

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Ecosystem-based adaptation initiatives include the sustainable management, conservation and restoration of ecosystems to provide services that help people adapt to the adverse effects of climate change. Building economic resilience in fishing communities (building capacity of communities to benefit from broader economic activities such as recreation and tourism) requires policy formulation to focus for sustainable Blue Economy related activities development.

Step 3: Working to Achieve Goals

Identification of main obstacles: The prime task to support a sustainable Blue Economy is to identify the obstacles for its implementation. Major obstacles to practice a sustainable Blue Economy in Bangladesh could be due to lacking of straight forward planning and policy for Blue Economy, integration among the sectors, infrastructural facilities and skilled manpower. Education and capacity building: Education and capacity building are important for an efficient and sustainable management of activities in sea. This can be achieved by offering the course about the ocean at the school and college level. Higher study on the ocean science is important for developing skilled manpower. In addition, ocean literacy programm among the stakeholders will stimulate more effective and sustainable economic use of ocean. Application of appropriate and new technologies: Application of new technologies can bring maximum economic return from the ocean while at the time these will help to either adapt with climate change consequences or mitigate the extreme events risks. Few examples include (Box 1) Artemia cysts production in salt pan, floating agriculture, salt tolerant agriculture, desalinization of water and conversion of existing island to Model Island, eco-tourism development.

Special interventions should be taken for fisheries sector. Such interventions include expansion of the commercial fishing area (beyond the 80 m depth) for harvesting high value fish species, exploration for new fishing grounds and fisheries, reducing post-harvest losses, domestication of new species i.e. seabass, mullet, hilsa, grouper, mud crab, turtle, oyster, seaweeds, adoption of innovative fish/shellfish farming i.e. marine cage culture, aquasilviculture, integrated multi-trophic aquaculture, live feeds i.e. rotifers, artemia biomass production for hatchery for sustaining the mariculture industry.

Direct access to financial support: Direct access to financial support will make the coastal communities economically solvent. This can be achieved by offering loan from the bank to the stakeholders as well as offering alternative income generating options. In coastal areas farmers are often facing crop damage due to climate change extreme events. Thus, crop insurance can be introduced to minimize the loss of the farmers.

Enforcement and surveillance for improved governance: Enforcement and surveillance for improved governance are important for managing and using the ocean and resources in a way that keeps the ocean healthy, productive, safe, secure and resilient. For a good ocean governance practice, it is crucial to adopt a holistic approach integrating all marine and maritime issues in Bangladesh.

Investment in restoring and protecting climate resilient and productive ecosystem: Investment is required to protect and restore the mangrove, coral, sea grass, salt marsh,

and mussel and oyster habitats. In this case community based ecosystem by offering community financial benefits can be fruitful.

Policies to increase the resilience of the ocean environment: Policies to increase the resilience of the ocean environment should focus on the establishment of green hotels; sewage treatment facilities, sustainable aquaculture to reduce wild catch; restoration of mangroves and building oyster reef to prevent coastal erosion rather than built barriers. A robust set of mandatory environmental rules to ensure the use of marine resources sustainably, wherever they operate should put in place.

Greater collaboration to integrate cross-border policies: Greater collaboration to integrate cross-border policies to safeguard the underlying ecosystems they share, including coordinated actions by government agencies (e.g., close season for hilsa in Bangladesh, India and Myanmar). Operationalization of SDG 14: Operationalization of SDG 14 is important for ocean conservation and sustainable use.

Research and marine spatial planning: Research activities to generate knowledge are essential components for certainty and security of sustainable Blue Growth. In this context ocean monitoring is a prime need at this moment. Special focus is also required on marine natural product extraction and marine biotechnology. Region wide spatial planning, mapping and development tools are required to guide in decision making for sustainable use of space. Adoption of protected area concept to design marine reserve, fish sanctuary and ecological critical areas are also important. Proper implementation of above mentioned activities will help to achieve the goal (step 4).

CONCLUSION

In comparison to other natural resource systems, the potential of coastal and marine ecosystem of Bangladesh, as a driver of economic growth, has long been overlooked by the policy makers. Only recent years, the Bangladesh government has given priority on exploitation and management of marine resources. However, the vast potential of Bay of Bengal for the national economic development is still not fully realized. To achieve the sustainable Blue Economy goals sustainable management and utilization is the first priority. Despite the fact that oceans are critical to our survival and to that of the majority of the world's plants and animals, we continue to abuse the vast ocean. Climate change and human interference make up the major threats to our oceans. Climate change extreme events are making oceans warmer and more acidic, endangering coral reefs. In addition, cyclones and sea level rise are heavily affecting the coastal communities.

To make the climate change resilience Blue Economy concept fully functional for the Bangladesh, there is an urgent need to foster a structural approach to implement further activities. These activities should consider both environmental and economic benefits. For example, (Figure 7), initiatives like mangrove plantation, restoration and conservation, building oyster reef, conserving salt marsh, sea grass and mussel beds can contribute in atmospheric carbon reduction, erosion protection, sea level rise protection, protection from cyclone and flood risk. These marine resources are also able to contribute in livelihood enhancement by offering employment opportunities and food. Marine Protected Areas (MPAs) will help to conserve the biodiversity while marine spatial planning (MSP) will contribute in zoning the areas for species economic activities

performance. Introduction of salt tolerant agriculture and use of renewable energy will ensure resilience to saline water intrusion and pollution, efficient use of energy, food security and protection of the environment.

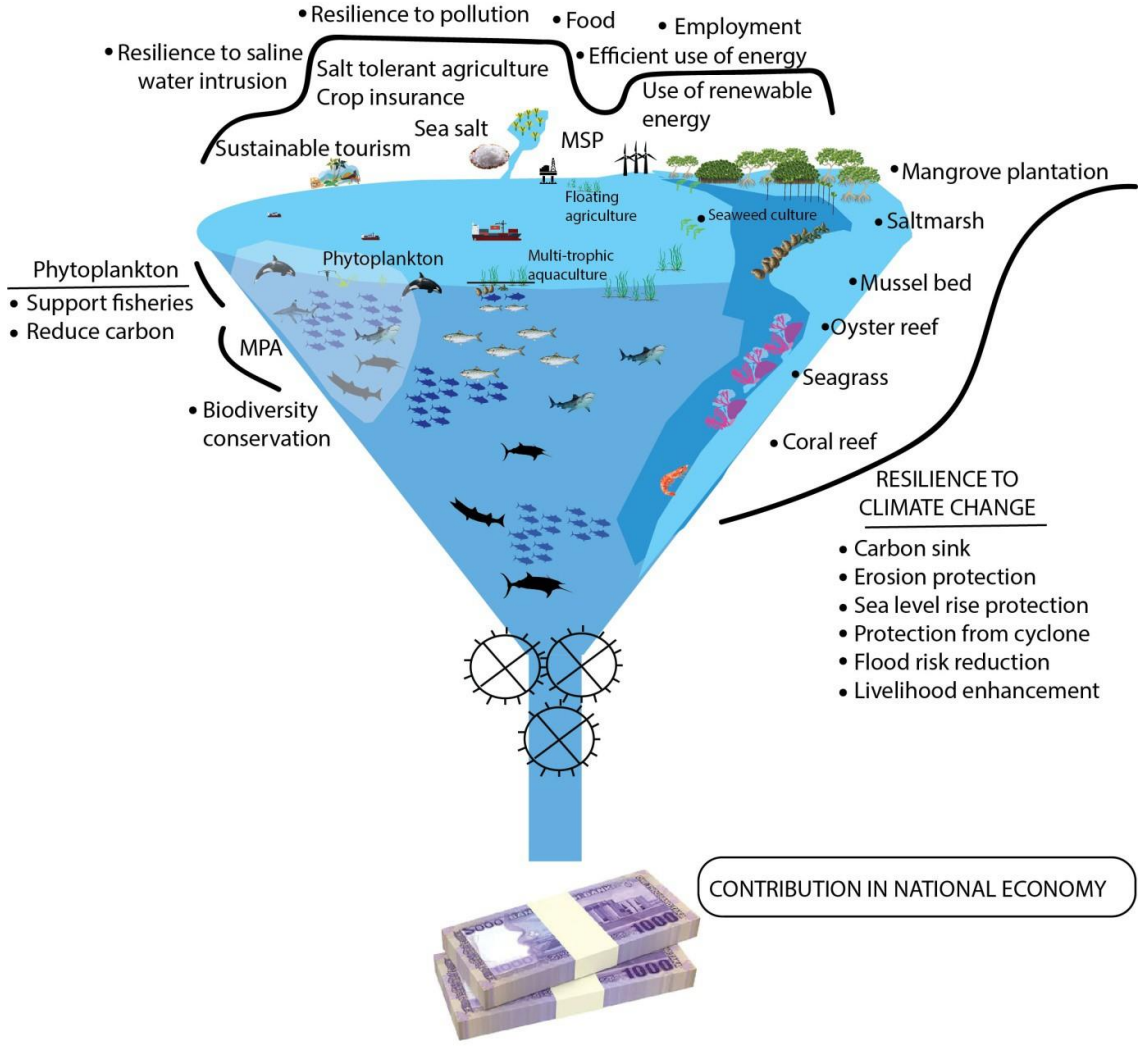

Figure 7 Schematic presentation of how components of Blue Economy can build climate change resilience and provide economic benefits.

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