

OCEAN/BLUE ECONOMY FOR BANGLADESH

Rear Admiral M. Khurshed Alam, Secretary, MAU, MOFA

Oceans cover 72% of the surface of our blue planet and constitute more than 95% of the biosphere. Life originated in the oceans and they continue to support all life today by generating oxygen, absorbing carbon dioxide, recycling nutrients and regulating global climate and temperature. Oceans provide a substantial portion of the global population with food and livelihoods and are the means of transport for 80% of global trade [1]. The marine and coastal environment also constitutes a key resource for the important global tourism industry and expanding domain of nature-based tourism. The seabed currently provides 32% of the global supply of hydrocarbons with exploration expanding. Advancing technologies are opening new frontiers of marine resource development from bio-prospecting to the mining of seabed mineral resources. The sea also offers vast potential for renewable "blue energy" production from wind, wave, tidal, thermal and biomass sources.

Throughout and subsequent to the Rio +20 process there has been a growing appreciation that the world's Oceans and Seas require more in depth attention and coordinated action. This has been reflected in various initiative *sinter alia* the UNDESA expert group meeting on Oceans, Seas and Sustainable Development, the work of the Global Ocean Commission, the Global Partnership for Oceans and the prominence given to oceans and seas in the UN five-year Action Agenda 2012-2016. Healthy oceans are essential for global food security, livelihoods and economic growth. The oceans are both an engine for global economic growth and a key source of food security. Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. This definition, from the World Summit on Food Security held in Rome, 2009, has four pillars with regard to food supplies: availability or adequacy (either domestically grown or imported), stability, access, and utilization of food (at the household level). The world faces one of the biggest challenges of the 21st century: how to feed 9 billion people by 2050 in the face of climate change, economic and financial uncertainty and the growing competition for natural resources. These multiple challenges require an integrated response and an urgent transition of the world economy towards a sustainable, inclusive and resource efficient path.

Framework for Sustainable Development

The Blue Economy conceptualizes oceans and seas as "Development Spaces" where spatial planning integrates conservation, sustainable use of living resources, oil and mineral wealth extraction, bio-prospecting, sustainable energy production and marine transport. The Blue Economy approach is founded upon the assessment and incorporation of the real value of the natural (blue) capital into all aspects of economic activity (conceptualization, planning, infrastructure development, trade, travel, renewable resource exploitation, energy production/consumption). Every country must take its share of the responsibility to protect the high seas, which cover 64 % of the surface of our oceans and constitute more than 90% of their volume. With a view to improving food security, eradicating poverty and delivering shared prosperity, global leaders, ocean practitioners, scientists, and representatives from government, business, civil society and international organizations must come together to explore action-oriented partnerships, governance arrangements, investment frameworks and new financing vehicles to turn the tide not only on the health of Oceans but also how the resources of the sea could be used for economic emancipation. There is need to demonstrate measurable steps towards critical internationally agreed targets for fisheries,

aquaculture, habitat protection and pollution reduction. It should also highlight the need to address the next frontiers of successful integrated approaches that include public-private partners, secure financing and catalyze good ocean governance while reconciling tensions and balancing priorities between (i) growth and conservation, (ii) private sector interests and equitable benefits for communities and (iii) Areas beyond national jurisdiction and Exclusive Economic Zones (EEZ) within the 200-mile limit) from the coast.

Balancing Growth and Conservation

Governments, policy makers and international institutions keen to boost food security and eradicate poverty face a careful balancing act between conservation and growth. While fisheries and aquaculture generate considerable social and economic benefits for hundreds of millions of people around the world, and have the potential to increase their contribution to human well-being and growth, sustainable development, based on the pillars of ecological, social and economic sustainability, entails reconciling several intersecting agendas. There is also a need to link institutions that deal directly or indirectly with ocean issues across spatial and jurisdictional scales in ways that are efficient and effective, avoiding duplications and conflicts. National governments can play a key role in addressing these challenges, acting in their own and in concert with others through international treaties including National/Regional Fisheries Management Organizations and other regional mechanisms such as the Regional Seas Program of the United Nations Environment Program (UNEP).

Balancing private sector growth and equitable benefits for communities

Globally, fish provide about 3 billion people with almost 20 percent of their average per capita intake of animal protein. Over 90% of small-scale fisheries come primarily from developing countries. In some countries, fish accounts for more than 50 percent of the animal protein intake. While governments can create legal, regulatory and policy frameworks and incentives, it is the private sector that is the main driver of economic growth through investment and entrepreneurial initiatives which range from global billion-dollar corporations that are vertically integrated to small-scale fishers. Strong momentum exists to reshape the context in which the private sector, independently of its scale, currently operates in order to ensure sustainable growth with equitable benefits for communities. In the Rio+20 outcome documents, The Future We Want, members of the international community agreed to "encourage the private sector to contribute to decent work for all and job creation for both women and men, and particularly for the youth, including through partnerships with small and medium enterprises as well as cooperatives." These objectives require policies that create incentives for producers and consumers to adopt sustainable practices and behavior. These principles for private sector growth and equitable benefits are also enshrined in a number of internationally adopted instruments developed to guide policy makers in decision-making on development in fisheries, namely the Code of Conduct for Responsible Fisheries, the Right to Food Guidelines, the Voluntary Guidelines for the Responsible Governance of Land, Fisheries and Forestry in the Context of National Food Security and the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries.

Uniting EEZ and Areas Beyond National Jurisdiction (ABNJ)

There are a number of common issues that have an impact in EEZs and in the high seas in regard to resource use and conservation. From small-scale artisanal fisheries to large-scale industrial fisheries, and whether in national waters or ABNJ, the related issues of

who has the right to exploit the fishery's resources and the nature of that right are a key part of the sustainable management of the resource. Marine pollution includes, but is not limited to, plastics, metals, glass, concrete and other construction materials, paper, polystyrene, rubber, rope, textiles and hazardous materials, such as munitions, asbestos and medical waste. Marine debris may result from activities on land or at sea and is a complex cultural and multi-sectoral problem that exacts tremendous ecological, economic, and social costs around the globe.

The Blue Economy – Opportunities

Blue Economy offers a suite of opportunities for sustainable, clean, equitable blue growth in both traditional and emerging sectors;

Shipping and Port Facilities-80 percent of global trade by volume, and over 70 per cent by value, is carried by sea and handled by ports worldwide. For developing countries, on a national basis, these percentages are typically higher. World seaborne trade grew by 4% in 2011, to 8.7 billion tons [2] despite the global economic crisis and container traffic is projected to triple by 2030[3]. Coastal countries need to position themselves in terms of facilities and capacities to cater for this growing trade and optimize their benefits. Shipping is the safest, most secure, most efficient and most environmentally sound means of bulk transportation – with declining rates of accidents, zero terrorist incidents, improving turnaround of ships and significant reductions in discharges to sea or emissions to air. Much of these advances have been made possible as a result of IMO's regulations, industry initiatives and technological developments; by helping to build technical maritime capacity in developing countries, where some 70%-75% of the world's merchant fleet is now registered.

Fisheries –Fish accounts for 15.7% of the animal protein consumed globally. The value of fish traded by developing countries is estimated at US\$ 25 billion making it their largest single trade item. In 2009 marine capture production was 79 million tons [4]. Human activity has directly and markedly reduced ocean productivity; additional deficits may be due to climate change increasing ocean stratification and reducing nutrient mixing in the open seas. Global Ocean Observing System (GOOS) and LME assessments show significant warming trends from which model projections 2040-2060 forecast a steady decline in ocean productivity [5]. The implementation of integrated, ecosystem-based approaches based on the best available science in a precautionary context, plus the removal of fishery subsidies that drive overexploitation offer the prospect of restoring key stocks and increasing catches. The implementation of sound management measures brings the promise of increased sustainable catches, lower energy utilization and costs; thereby securing livelihoods and enhancing food security.

Aquaculture- Aquaculture is the fastest growing global food sector now providing 47% of the fish for human consumption [6]. Fish used for human consumption grew by more than 90 million tons in the period 1960-2009 (from 27 to 118 million tons) and aquaculture is projected to soon surpass capture fisheries as the primary provider of such protein. Aquaculture with fed species, if not managed properly, can impact biodiversity and ecosystem functions through excessive nutrient release, chemical pollution and the escape of farmed species and diseases into the natural environment. Growth in aquaculture sector in Asia, which accounts for more than 89% of global production, is more than 5% a year. Aquaculture offers huge potential for the provision of food and livelihoods, though greater efficiencies in provision of feed to aquaculture need to be realized, including reduced fish protein and oil and increased plant protein content, if the industry is to be sustainable.

Aquaculture under the Blue Economy will incorporate the value of the natural capital in its development, respecting ecological parameters throughout the cycle of production, creating sustainable, decent employment and offering high value commodities for export.

Tourism- Marine and coastal tourism is of key importance to many developing countries. Tourism is a major global industry; in 2012 international tourist arrivals increased by 4% despite the global economic crisis and constituted 9% of Global GDP (direct, indirect and induced impact). In 2012 tourism supported 9% of global jobs and generated US\$ 1.3 trillion or 6% of the world's export earnings[7]. International tourism has grown from 25 million in 1950 to 1,035 million in 2012 and the UNWTO forecasts further growth of 3-4% in 2013[8]; the forecast for 2030 being 1.8 billion. Trends in aging populations, rising incomes and relatively low transport costs will make coastal and ocean locations ever more attractive. Cruise tourism is the fastest growing sector in the leisure travel industry; overall, average annual passenger growth rates are in the region of 7.5% and passenger expenditures are estimated in the order of US\$ 18 billion per year [9]. The tourism consumer, however, is driving the transformation of the sector with a 20% annual growth rate in ecotourism; about 6 times the rate of growth of the overall industry. Higher education courses need to deliver a solid grounding in the specific skills needed to maintain and increase market share in a discerning and competitive global market.

Energy-In 2009 offshore fields accounted for 32% of worldwide crude oil production and this is projected to rise to 34% in 2025[10] and higher subsequently, as almost half the remaining recoverable conventional oil is estimated to be in offshore fields - a quarter of that in deep water[11]. Deep water oil drilling is not new, but market pressures are making the exploration for and tapping of evermore remote reserves cost effective, bringing the most isolated areas under consideration. Methane hydrates, a potentially enormous source of hydrocarbons, are now also being explored and tapped from the seabed. Oil will remain the dominant energy source for many decades to come but the Ocean offers enormous potential for the generation of renewable energy - wind, wave, tidal, biomass, thermal conversion and salinity gradients. Of these the offshore wind energy industry is the most developed of the ocean based energy sources. Global installed capacity was only a little over 6 GW in 2012 but this is set to quadruple by 2014 and relatively conservative estimates suggest this could grow to 175 GW by 2035[12].

Biotechnology- The global market for marine biotechnology products and processes is currently estimated at US \$ 2.8 billion and projected to grow to around US\$ 4.6 billion by 2017. Marine biotech has the potential to address a suite of global challenges such as sustainable food supplies, human health, energy security and environmental remediation [13]. Marine bacteria are a rich source of potential drugs. In 2011 there were over 36 marine derived drugs in clinical development, including 15 for the treatment of cancer. One area where marine biotech may make a critical contribution is the development of new antibiotics [14]. The potential scope is enormous, by 2006 more than 14,000 novel chemicals had been identified by marine bio-prospecting and 300 patents registered on marine natural products[15]. The unexplored and understudied nature of much of the underwater world means that the capacity of marine organisms other than fish and shellfish to provide inputs to the blue economy is only just beginning to be appreciated, partly through new gene sequencing technologies for living organisms. There have already been successes. The anti-viral drugs Zovirax and Acyclovir were obtained from nucleosides isolated from Caribbean sponges. Yondelis, developed from small soft-bodied marine animals was the first drug of marine origin to fight cancer.

In the very short term, the sector is expected to emerge as a niche market focused on high-value products for the health, cosmetic and industrial biomaterials sectors. By 2020, it could grow as a medium-sized market, expanding towards the production of metabolites and primary compounds (lipids, sugars, polymers, proteins) as inputs for the food, feed and chemical industries. In a third stage, around 20 years from now and subject to technological breakthroughs, the blue biotechnology sector could become a provider of mass-market products, together with a range of high added value specialized products. Accelerating this process will require a combination of basic research on ocean life and applied research on possible industrial applications with low probabilities but high rewards for success.

Submarine mining—The world is gearing up for the exploration and exploitation of mineral deposits on and beneath the sea floor. Industry, due to rising commodity prices, is turning its attention to the potential riches of polymetallic nodules, cobalt crusts and massive sulphide deposits; the latter a source of rare earth elements, such as yttrium, dysprosium and terbium, important in new ICT hardware and renewable energy technologies. Commercial interest is particularly strong in polymetallic nodules and in seafloor massive sulphides. The International Seabed Authority has developed the Mining Code regulations^[16] to meet these changing circumstances and has commenced issuing licenses for the exploration of the international sea floor. Coastal countries need to prepare themselves to ensure they realise optimal benefits from resources in their own EEZs and likewise that their concerns are incorporated into the measures to manage the coming race for the riches of the seabed. The exploitation and mining of minerals, other than sand and gravel, from the sea have just started. By 2020, 5% of the world's minerals, including cobalt, copper and zinc could come from the ocean floors. This could rise to 10% by 2030. Global annual turnover of marine mineral mining can be expected to grow from virtually nothing to €5 billion in the next 10 years and up to €10 billion by 2030.

It may also become economically feasible to extract dissolved minerals, such as boron or lithium, from seawater. The most promising deposits are found in metallic sulphides which emerge from hydrothermal ore deposits (such as 'black smokers') in volcanically active zones. The temperatures and pressures in these regions are extreme and the impact of disturbance on these hot spots of marine biodiversity, which under the UN Convention on the Law of the Sea (UNCLOS) should be protected, is largely unknown. However there are opportunities outside jurisdictional marine areas. In these areas, the International Seabed Authority (ISA) is responsible for organizing and controlling activities, including monitoring all mineral-related activities. Their continued competitiveness depends on access to finance in an inherently risky market, targeted research and development in extraction techniques, the ability to obtain licences in international waters and robust measures to avoid harming unique ecosystems.

Governance - Each sovereign country is responsible for its own resources and sustainable development. Whether it be with regard to updating and advancing governance mechanisms to ensure the sustainable development of waters beyond national jurisdiction (e.g. maritime security, high seas MPAs, sustainable fisheries, oil and mineral extraction) or assistance in enabling the effective management and utilization of national EEZs (e.g. technology transfer, technical assistance, marine spatial planning), capacity building, finance to support national marine spatial planning and effective monitoring, control and surveillance). A key component of international cooperation for the Blue Economy approach is **Research**. A science-based approach is essential to the development of the Blue Economy; commencing with the initial assessment and critically the valuation of the blue capital at our disposal. This will provide a basis for informed decision-making and adaptive

management. This major undertaking must be addressed and continually refined and upgraded in line with changing circumstances, evolving technologies and our increasing understanding; or the Blue Economy approach will founder. This underlines the importance of technical assistance, technology transfer and capacity building to the pursuit of sustainable development.

Charting a new course for Bangladesh with the resources of the Blue Ocean/Sea

The objective of the Blue economy initiative – the maritime pillar of the future strategy – is to promote smart, sustainable and inclusive growth and employment opportunities in Bangladesh’s maritime economic activities in the short, medium and long-term time frames. The Blue economy initiative specifically aims to promote synergies and foster framework conditions that support specific maritime economic activities and their value chains. The extensive review and analysis of Blue Growth potential has confirmed the potential of the Blue Economy as an untapped resource. To realize the necessary international cooperation and support to elevate the Blue Economy to the international sustainable development agenda [17], Bangladesh amongst the coastal countries has targeted the preparatory process leading up to the first International Workshop on Blue Economy in Sep 1-2, 2014 in Dhaka. Full development and endorsement of the proposal by the Government would constitute the next step in securing international momentum for, and acceptance of, the Blue Economy as an approach distinct from, but mutually supportive with, the general economy.

Hon’ble Prime Minister during the workshop emphasized that that Blue Economy could play an important role in the economic upliftment of the country in the context of poverty alleviation, ensuring food and nutrition security, combating climate change impacts. Underlining Blue Economy as a window of opportunity for development, the Prime Minister expressed her resolve to turn the Bay of Bengal to a hub of economic development and prosperity; and observed that marine resources and services could significantly contribute to development of potential sectors like pharmaceuticals and agro-based industry and could also enhance foreign trade and foreign exchange. She, however, identified the lack of skilled human resource, institutions and technology as key challenge for Bangladesh to effectively utilize the marine resources. She also maintained that Bangladesh had already accorded priority to fishery, maritime transportation, ship-recycling, ship building, and coastal tourism considering their huge potential. She re-affirmed Bangladesh’s commitment to conservation and balanced development of natural resources keeping integrity of environmental and bio-diversity aspects while pursuing development for the people of the country. She expressed hope for the Workshop to come up with pragmatic guidance and perspectives towards development of blue economy.

The Workshop recognized blue economy as striving for attainment of sustainable development, taking into account advantages and strategies of managing the oceanic resources. They recognized that in such a way, growth of economy and people could be ensured together with ensuring the carrying capacity of oceans. It highlighted the importance of engagement on: increasing sustainable fishing capacity and creating alternative job opportunities; promoting sustainable management of small-scale marine fisheries; supporting artisanal communities’ access to information, technology, finance, regulation and governance processes with a view to securing them year-round livelihood from alternate sources; enhancing capture fisheries’ share in fish production through protecting/restoring critical habitats; encouraging private sector investments in coastal mariculture; collaborating among international community to end overfishing, effectively regulating harvesting and ending illegal-unreported-unregulated (IUU) fishing and

destructive fishing practices; and supporting the countries-in-need on implementation of their science-based management plans towards restoration of fish stocks to sustainable yield level; strengthening regional governance/ institutions in Areas Beyond National Jurisdiction (ABNJ) management.

They also noted that in many of the Large Marine Eco-system (LME) across the world, including the Bay of Bengal LME, conservation and development of marine resources need to be pursued through coordinated strategic frameworks e.g. Strategic Action Program (FAO, Aug 2014), Integrated Management of the Marine Ecosystem (IMME) in taking forward existing international obligations. Experience of innovative (national) undertakings e.g. Delta Action Plan[18] (*involving Bangladesh*), should also have coastal and marine sector related elements. It was understood that while there is substantial energy potential to harness from traditional and emerging marine sources[19] in sustainable manner, in so doing, existing sub-regional, regional and global arrangements would also need to weigh and address the issues related to resource governance, equitable sharing of benefits, access to technology and finance by the countries. Consequently, capacity-building needs to be approached and planned in regard to adequate development of governance and institutional framework(s), effective legislative framework, academic and research institutions, managerial-technical-technological capabilities and qualified, comparable skills (*in existing and emerging streams*). This should also relate to ensuring an equitable governance of seas and oceans and avoid unsustainable competition for ocean space and resources. Partnership(s) among and between stakeholders – within and across countries and oceans and seas and international systems - is critical in facilitating greater flow of expertise, finance, capacity to effectively close gaps e.g. support effective participation of those States in regional fisheries management and other exploitation techniques required for non-living sea resources as also ensuring freedom of navigation. To-date, UNCLOS provides the most widely accepted legal instrument in governance of all aspects of oceans and seas, including marine resources. It was additionally underlined that the existing regional and international regimes and arrangements could further complement the global efforts and objectives towards conservation and sustainable use of oceans and seas and their resources by the State parties.

Blue Economy for Bangladesh

The Blue economy approach emphasized that ideas, principles, norms of Blue Economy lend significant contribution towards eradication of poverty, contributing to food and nutrition security, mitigation and adaptation of climate change and generation of sustainable and inclusive livelihoods. Thus Blue Economy requires a balanced approach between conservation, development and utilization of marine and coastal eco-systems, all oceanic resources and services with a view to enhancing their value and generates decent employment, secure productive marine economy and healthy marine eco-systems. Primarily, blue economy should have adequate focus on well-being and livelihood of people; and engagements between countries and stakeholders on Blue Economy should be based on the principles *inter alia* of mutual trust and respect, equitable mutual benefit, and sharing of benefits to secure sustained and beneficial outcomes of all ocean-centric enterprise. It is needless to say that for most developing States particularly for Bangladesh, making transition to Blue Economy would entail fundamental and systemic changes in their policy-regulatory-management-governance framework(s) and identification of various maritime economic functions.

Maritime functions in the context of Blue economy are not just economic sectors; they cover the relevant maritime value chains – including backward and forward linkages.

This is important since large parts of the economic activities take place not in core sectors themselves, but in adjacent economic activities. Twenty six maritime economic functions can be identified from among the fishery, maritime trade and shipping, energy, Tourism, coastal protection, maritime monitoring and surveillance. In each of these functions, full account is taken of the value chains that are developed across a range of sectors. The following summarizes all maritime economic activities that have been identified and whose developments are now at various stages;

Maritime trade and shipping

Shipping-International shipping contributes to the three pillars of sustainable development facilitates global commerce, the creation of wealth and prosperity among nations and peoples, creating a wide variety of jobs on board ships and ashore, with direct and indirect beneficial impacts on the livelihoods of others. In comparison to other transport modes, it provides the most environmentally sound and energy-efficient means of moving huge quantities of cargoes and people. International shipping is the carrier of world trade, transporting around 90% of global commerce. Without it, the bulk transportation of raw materials and the import and export of affordable food and goods would simply not be possible. The global regulatory framework is provided by the International Maritime Organization (IMO), which has adopted 52 treaties regulating ship design and operation. The most important of them – concerning the safety of life at sea and the protection of the environment – today applies on 99% of the world's merchant fleet.

More than 90% of the Bangladesh's external freight trade is seaborne – and on-going globalization has made this flow ever more important. The long coastline and age old tradition of sea navigation in Bangladesh have led to a relatively strong development of maritime services that support the sea trade and sea transport function (ranging from shipping agents, freight forwarders, and insurance to classification and inspection, and maritime education in the Marine Academies/Dockyards/Shipyards/ Nautical Institutes etc). Presently Bangladesh's value of export and import stands at about USD 67 billion (2013-14) and are carried by 2500 foreign ships visiting our ports. Against our import and export value, during last ten years, importers, exporters and buyers has paid USD 95 billion as freight and related charges to shipping companies, air lines and freight operators to carry goods in and out of Bangladesh. There are only 74 registered (2014) Bangladeshi merchant ships which are not sufficient to carry even a fraction of our cargo. Considering the average import growth rate of 15.79% (last 10 years) and export growth rate of 15.43% (last 10 years), projected freight value for next ten years would be around USD 435 billion. In order to retain parts of the USD 400 billion in the country, over the ten years, Bangladesh must facilitate local shipping companies to add more ships to the existing fleet, freight operators to establish freight services including container liner services to carry goods to/from Bangladesh using our own as well as chartered ships and freighters.

Coastal shipping/Feeder services- It means national and international freight transport within and to/from neighbouring countries with medium sized ships. Coastal shipping forms an important means of transport within most of the transport system and this figure will be higher for Bangladesh having extended coastlines along the rim of the Bay of Bengal. It caters to the transport needs of economies by providing maritime point-to-point transport of all kinds of commodities; provides the maritime link that connects the road network across the seas; serves as feeder transport distributing container flows from the major seaports hubs to smaller ports, or other land locked countries. For the long term annual growth expected in the range of 5-6 percent for the coming decade, coastal shipping from India, Sri Lanka, Singapore, Malaysia, Thailand and Myanmar ports could play as a

game changer in the feeder services. Such transshipment at Singapore, Kelang, Colombo and other ports of the region would be cost effective, save time and increase employment opportunities.

Sea ports-Infrastructure like ports can be used by different economic activities and is a fine example of synergy. It goes without saying that ports are important crystallization points for maritime economic activities: whether cruise shipping, coastal shipping, international shipping, passenger ferries, fishing, marine mineral mining, oil drilling, offshore or maritime monitoring, they all require ports and ports infrastructure. There are strong synergies with international shipping, which not only provides the overseas cargo, but also shapes the main ports. Port planning needs to be addressed in a wider sense - by identifying the main functionalities of ports and by building whole value chains around them - important synergies emerge here in terms of supply industry as well as tourism. Statistics reveals that economy of Bangladesh is heavily dependent on international trade where maritime ports play the key role of transporting 94% of our foreign trade. Bangladesh must enhance the existing handling capacities of ports and develop deep sea ports with more capabilities and modern handling equipment in Sonadia, Matarbari and Payra to cater for increased trade and commerce. Establishment of seaports can significantly reduce export lead times and earn steady flow of revenue for the country.

Passenger ferry services- Transporting passengers on fixed sea routes, sometimes this is combined with Ro Ro transport. Passenger ferries provide synergies as well while inland shipping is another essential component of the chain. During 2012 about 231.5 million passengers and 32.6 million Mt of cargoes were transported through inland/coastal networks leaving sufficient scope for further investment and expansion around the coastal belt.

Inland waterway transport- Bangladesh has one of the largest inland water transport network in the world covering 24,000 km long with 1000 landing points and 21 inland river ports. Pangoan Inland container terminal with 55,000 sq m of container yards, 2400 TEUS handling capacity and with two jetties have already been commissioned since Nov 2013. Chittagong Port handles about 1.5 million TEUS annually and 80% of then is bound for Dhaka and only 10% arrive Dhaka by rail. Now container can be carried by inland routes at a much cheaper cost. Bangladesh can raise its GDP by 1% while foreign trade by 20% if the IWT logistics system is made efficient and competitive according to Asian development bank report. There are more than 10,000 inland vessels, 75 coastal vessels and about 6500 inland ships registered with department of shipping and almost all these vessels are built inside Bangladesh. The major navigation routes in Bangladesh are cantered at some important river ports such as Dhaka, Narayanganj, Chandpur, Bhairab, Barisal, Chittagong and Khulna. The connectivity of these ports especially in waterways is important for the economy. So the maintenance of the navigability of the rivers of the country should take priority which will in turn generate jobs, and is less expensive than road links.

Shipbuilding- Finally, the shipbuilding industry contributes to this function by providing the necessary equipment, which does not only cover ships but also the marine equipment in which our own industries can play an important role. There are more than 300 shipyards and workshops in Bangladesh and almost 100% requirement of inland vessels, fast patrol boats, dredging barges, passenger vessels, landing craft, tug, supply barges, deck loading barges, speed boat, cargo coasters, troop carrying vessels, hydrographic survey vessels, survey boat, pilot boats, water taxi, pontoons and water taxi are being built by these yards. Ship building yards are constructing 10,000 DWT Sea going ships for export and are expected to upgrade their capacity to 25000 DWT. In the Dry docks of Bangladesh

about 15 ships are being repaired annually earning foreign exchange. Shipbuilding industry not only earns foreign exchange but also saves it where as in road and rail transportation about 100% transport vehicles/rolling stocks are imported from abroad. It should be promoted and nurtured in all possible ways, including its horizontally and vertically linked businesses, and given opportunities and incentives for growth and expansion. Other similar manufacturing and engineering fronts should also be seriously explored.

Ship recycling industries- During 2013, about 300 ships were dismantled, which is the highest number in six years and Bangladesh ranked 2nd considering number of ships while ranked 3rd from the point of gross tonnage. It provides about 70-75% scrap steel as raw material for Steel and Re-rolling mills, saving lot of foreign currency. This industry not only met the growing needs of furniture, household fittings of all classes, boilers, life saving boats, generators etc but also employment opportunities. There are about 125 ship breaking yards with annual turnover of about USD 2.4 billion. Ship recycling must be turned into modern industry with all eco- friendly infrastructure and compliance of international convention.

Food and livelihood

Fishery- There are about 475 species of fish found in our EEZ compared to 250 species on land. Fish still provides the much needed protein needs of our people. About 57,000 artisanal mechanized and non mechanized wooden boats and 200 industrial steel body trawlers are engaged in fishing in the coastal waters upto 60 km (within 40m depth) from our coastline having very limited capability in catching pelagic fishing-shoals closer to surface. A considerable amount of fish are salted and dried, mainly for human consumption. Incidentally, the use of dried fish as a source of fishmeal is gradually increasing due to intensification of fish and poultry farming. Hilsashad (*Tenualosa ilisha*) is the target and single most valuable species with annual catch of 340,000 MT, and generates employment and income for 2.5 million people valued at \$US 1.3 billion per year (BOBLME 2012, Hossain *et al.* 2014). At present 50-60% of global hilsa catch takes place in the coastal and marine waters of Bangladesh, 20-25% in Myanmar, 15-20% in India and the remaining 5-10% in other countries. A total of 46,568 MT tiger shrimp (*Penaeus monodon*) was caught from BoB during 2012-2013 (DoF 2014), most of which directly go to the processing plant and end up in the markets of USA, EU and Japan. Over the last 10-15 years, live giant mud crab (*Scylla serrata*) and estuarine eel (*Muraenesox bagio*) have been exported to East Asian countries. Less than 20% exported live crab come from crab fattening by the marginal farmers of Satkhira, Bagerhat and Cox's Bazar coasts. Moreover, the harvest of young and undersized sharks and rays are dried, while the large sharks are dumped overboard after removing their fins and some other body parts. The majority of phaisa (*Setipinna phasa*) caught in the coast are used to make fermented fish product.

However, there are hardly any capabilities of catching demersal fishes below 50 m depth of water. Long lines fishing are totally absent in deep waters. In the benthic zone lowest level of the ocean-crustaceans-shrimp and lobster are caught in limited quantities but fishes close to sea bottom at about 150-550m depth cannot be caught along with cephalopod-octopus and squid industrial fishing. In the Bay of Bengal 8 million tons of fish are caught by other countries where Bangladesh's share is only 73,000 tons (2013). There is tremendous scope for increasing marine catch introducing technology and long line, incentives for bigger ocean going trawler, huge scope for higher end industry in venturing beyond 60 km coastline. A calculated proportion of the bottom trawls have already been converted to mid-water trawls in order to lessen pressure on the demersal fish stocks, to reduce destruction of sea-bottom habitats, and to exploit the mid-water fish stocks. A

temporary ban on fishing in a certain period of the year has been imposed for several years now to allow breeding and recruitment of important fishes, specifically Hilsa. Several Marine Protected Areas (MPA) have also been declared to maintain marine biodiversity and fish stocks at sustainable levels. Destructive fishing methods and gear (e.g., set bag net) have been completely banned from operation. Vessel Tracking and Monitoring System (VTMS) with satellite communication links are going to be installed soon in fishing vessels in phases, in order to monitor and control their manoeuvre at sea for various management purposes. In the environment sector, several Ecologically Critical Areas (ECA) have been enforced in various coastal ecosystems to maintain critical habitats, biodiversity, marine turtle breeding and conservation, and mangrove restoration and growth

Bangladesh must now look for other important uses of fish parts etc. as is done in other countries. Fish oil could be used for fat liquoring of leather, tempering of metals, batching of jute and insecticidal soaps, paints and varnishes, and in pharmaceutical products. Fish liver oil could be used for treatment of Vitamin A & B deficiency diseases, pharmaceutical applications and animal feed formulations, fish liver residue and fish ensilage may be mixed with fishmeal, fish maws from eel and catfish can be turned into isinglass into thin strips of sheets 1/8 to 1/4 thickness, can be used as clarifying agent for wine, beer and vinegar etc. Fish hydrolysates and peptone enhances nutritional value of foods, and can be used as media for culturing terrestrial and marine bacteria. Some of the important applications of chitin/chitosan, and extract from prawn waste are in textiles sizing and dyeing of cotton, wool, synthetic fabrics, paper, treatment of wounds and hyper acidity etc ,burnt spine of stingray with vinegar relieves toothache. Red algae found in Sunderban as food, agar-preservation of cooked fish and meat, water proof paper, ice cream, jelly ,candy ,bread and biscuits, algin and alginates- from brown marine algae uses in agar and sargassum, brown algae- calcium alginate used in surgical dressing to reduce bleeding, jellyfish, snails, sea cucumbers and horse crabs produce various drugs, sponges- antibiotic capabilities, pearl bearing oysters good for culture ,oysters are source of pearls oysters and mussels are edible, artemia nauplii- for aquatic animals, artemia cysts excellent live food ,hatcheries and for growing larvea of crustaceans , seaweeds and sea grass-benthic marine and brackish water can be used for food, iodine, fodder, fertilizer, cosmetic and pharmaceuticals products.

Future development prospects of aquaculture appear promising. Well-managed coastal aquaculture and mariculture offer significant scope for green growth and employment opportunities for coastal communities at low levels of CO2 emissions when compared to other protein production systems. Extracting wild natural resources (essentially fish) for animal consumption could be done and used by agriculture and aquaculture. The momentum of the fast increasing aquaculture (by 160% over last decade) and with its huge success in inland aquaculture, Bangladesh should replicate such expertise insea aquaculture for seaweed, pearl and oyster. Strengthening regional fisheries bodies, national fisheries management agencies, fishing community and fish workers organisations and private sector associations is critical to sustainable and equitable use of marine resources through aquaculture.

Marine aquatic products- Marine aquatic products consist of the farming of marine aquatic organisms, mainly for human consumption and all the associated primary processing activities. While cultivation of aquatic plants and algae is still to be evolved, farming of aquatic animals composed of three major sub-sectors: marine shellfish farming (e.g. oysters and mussels), marine finfish farming and freshwater finfish farming (trout, carp, eel, etc.) could be considered for cultivation. Algae extracts are used in cosmetic, nutraceutical and pharmaceutical markets (macro algae and micro algae). There are already

several products on the market such as PUFA's (poly unsaturated fatty acids) like omega-3 and omega-6, but also antioxidants. Macro algae producers can target the human *food market*(already happening in Asia) but also the animal feed market. Some interviewees believe that macro algae will be a valuable source of proteins for human and animal consumption. Algae aquaculture can contribute to advances in fish medications and contribute to shelf life improvements achieved through marine bacteriological progress.

Marine Biotechnology- It is about unravelling the potential of the biodiversity of a specific earth compartment for the benefit of the rest of the economy. The unexplored and understudied nature of much of the underwater world means that the capacity of marine organisms other than fish and shellfish to provide inputs to the blue economy is only just beginning to be appreciated, partly through new gene sequencing technologies for living organisms. Exploration of the sea biodiversity is now helping us understand for example how organisms that can withstand extremes of temperature and pressure and grow without light could be used to develop new industrial enzymes or pharmaceuticals. It can provide bio-sourced products such as coating with anti-fouling or anticorrosive properties for maritime transport and shipbuilding. Blue biotechnology can also contribute to the development of specific biopolymers and bio membranes that improve the overall efficiency of the desalination process. Bio stimulation can also be used to protect natural habitats by fostering bioremediation after important pollutions (as for the Exxon Valdez oil spill when bacteria were stimulated to degrade hydrocarbons). Another example is bioremediation in case of oil spills. A conclusion from this example is that the maritime sector as a whole has strong interest in promoting new (bio-) technologies, cross-cutting services and suppliers that can benefit more than one sector – and bring about advantages that cannot always be foreseen. Marine biotechnology and industries based on biotechnology research are long overdue. Universities and research institutions should be encouraged and given funding & logistics for opening up this promising field for future industrial growth

Energy

Oil and gas- The upstream offshore oil and gas value chain consists of exploration (involving drilling rigs and research & specialized support ships), field development (building of platforms), production and exploitation. Downstream activities are refining and distribution to the consumer markets. Fossil fuels are those resources that can be extracted and processed in order to be used in various ways, especially in our energy supply that includes mostly natural gas and a potential new segment of oil at sea. Bangladesh is yet to assess the true potential of its offshore oil and gas prospects. Some 26 Tcf (trillion cubic feet) gas reserve has so far been discovered in Bangladesh, of which only about 1 Tcf is located in the offshore areas. Until 2014, 19 exploratory wells were drilled in the Bay of Bengal, resulting in only two gas discoveries, i.e. the Sangu and the Kutubdia, with small reserves. The Sangu reserves of 0.8 Tcf have already depleted, whereas the Kutubdia reserves 0.04 Tcf are yet to be developed. Moreover, the drilling of the Magnama (3.5 Tcf) and Hatia (1.0 Tcf) yet to produce any commercial volumes of hydrocarbons. Due to close proximity to the discovered gas fields of Myanmar, some Bangladeshi blocks are likely to have comparable geological structures and gas/oil prospects.

However, a logical plan is necessary to carry out multicline survey(using state of art technology) in Bay in order to identify potential oil and gas fields, and their reserves. A delay in the exploration may offset the opportunity of harnessing the oil and gas resources, especially those (if any) located on either side of the maritime boundary (India and Myanmar), because whoever drills last is likely to pull not only their fair share of gas and oil reserves but also from across the boundary. In fact, the country requires massive

exploration and drilling activities to increase its overall gas output. In the future, oil and gas exploration and exploitation must be accomplished with full participation between public and private sectors to share data and information, monitoring, and best practices, as well as monitoring and assessment protocols and results.

Sea salt production-Sea salt has been produced traditionally along the Cox's Bazar coast of Bangladesh for generations. In a longer dry season, the salt farmers can get about 20 tons/ha production. The annual salt production in the Cox's Bazar coastal segment of Bangladesh is 22MT, where the Samut Sakhon of Thailand produces 43MT. Most of the salt farms are small-scale, using manually operated local equipment and lease the land from landowners, or sometimes from the government on a yearly basis. Community-focused land leasing systems, sufficient credit facilities, use of mechanical equipment (water pump, leveler, etc.) and reliable weather forecasting can enhance salt production. Moreover, formation of salt farmer's cooperatives can ensure bargaining power and maximize economic return (i.e., salt price) for their standard of living.

Ocean renewable energy- Marine-based renewable energy such as wind, wave and tidal range and currents offers a significant potential to contribute to low-carbon energy supplies for regions with appropriate coastal features. Off-shore wind covers all activities related to the development and construction of wind parks in marine waters, and the exploitation of wind energy by generating electricity offshore. However, most suitable onshore locations for wind turbines need to be identified and the best (windiest) offshore sites have to be connected to the main transmission grid. A wind generator with a capacity of 2 MW has already been installed in the coastal area of Kutubdia, Bangladesh, but remains inactive.

Tidal energy, covering tidal range and tidal current, is the most advanced, Ocean Thermal Energy Conversion (OTEC) is based on the thermodynamic potential between the warmer upper water layer and the colder deeper water layer. Activities provide important synergies with ocean renewable energies, e.g. wave energy converters may help to attenuate wave attack and generate electricity. Marine-based renewable energy can provide alternative employment opportunities particularly for maritime communities who were formerly reliant on fisheries. Consistent long-term policies and targeted financial support from governments are needed if technical barriers and cost reductions are to be overcome. To implement this, incentives such as grants, subsidies and tax credits are required to encourage private investments in the large, expensive infrastructure that is required to move from small prototypes to pilot plants.

Blue energy (osmosis) and biomass-Osmotic energy is based on the salinity gradient between salt and fresh water. Nutrient loads from continents to oceans and the coastal zone have increased roughly three fold from pre-industrial levels, primarily from agricultural run-off and poorly or untreated sewage. Low levels of oxygen make it difficult for marine creatures to survive. Industrially produced nutrient fertilizers (nitrogen, phosphorus) are essential to global food security and have been the main driver of dramatically improved agricultural yields over the last sixty years to feed a growing population. At the same time, excess nutrients from inefficient use in farming and insufficient treatment of nutrients in wastewater, have made their way into rivers, aquifers, coastal areas and oceans, leading to degradation of marine ecosystems and groundwater at a global scale. Enhanced nutrient recovery and reuse would also help to ensure that phosphorus, with finite reserves, is increasingly recycled to maintain sufficient supplies to meet the long-term needs of human society.

Aggregates mining (sand, gravel, etc.)- Beach material commonly known as sand varies in colour ranging from dark-brown, gray, black, light brown, golden to silvery white. Several investigations have been carried out in the coastal region to find heavy materials in the sandy beaches of Bangladesh. Sands containing valuable heavy minerals are found intermittently over the length of a 250 km coastal belt from Patenga to Teknaf. The entire coastal belt has been explored with the discovery of 17 deposits of potentially valuable minerals such as zircon, rutile, ilmenite, leucoxene, kyanite, garnet, magnetite and monazite (Alam 2004). Proper extraction and commercialization of minerals from beach sand may enhance the growth of different industries such as welding electrodes, paper, glass, chemical and ceramic sectors in the country. So, by installing mineral extracting industries in the Teknaf region, it may be possible to create huge employment opportunities for the local community

Marine minerals mining - The deposits of marine minerals can be divided into three categories: (1) polymetallic sulphurs, (2) ferromanganese crusts, (3) (ferro) manganese nodules, and (4) rare earth elements and yttrium, and. They differ in composition, shape and location. Managed correctly this natural capital could be converted into jobs, infrastructure, public service improvements and growth in the domestic private sector. The deep-sea environment is one of the least understood regions of the planet and we still have a fairly rudimentary understanding of the ecosystem services these environments support. By 2020, an expected 5% of the world's precious minerals including cobalt, copper, zinc as well as rare earth can come from the ocean floors (up to 10% in 2030). Overall global annual turnover value of marine mineral mining can be expected to grow from virtually nothing up to € 5 billion in the next 10 years, and € 10 billion in the period up to 2030.

Tourism

Coastal tourism- Globally, coastal tourism is the largest market segment and represents 5 per cent of world GDP and contributes to 6-7 per cent of total employment. In 150 countries, it is one of five top export earners and in 60 it is the first. It is the main source of foreign exchange for one-half of Least Developed Countries (LDCs). Coastal tourism includes a) beach-based recreation and tourism, b) tourist activities in proximity to the sea, and c) nautical boating including yachting and marinas. Sustainable tourism can create new jobs and reduce poverty. Tourism is human-resource intensive. One job in the core industry creates one and a half additional jobs in the tourism-related economy. Efficiency improvements, local hiring, sourcing local products and safeguarding local culture and environment can reinforce employment potential. Increasing involvement of local communities in the value chain can contribute to the development of local economies and poverty reduction. The private sector must be mobilized to support sustainable tourism and needs access to financing for investing in greening practices.

Recreational water sports, yachting and marinas- Introduction of various water sports for recreational activities, construction and servicing of seaworthy pleasure boats and the required supporting infrastructure including marina ports could encourage growth of coastal tourism.

Cruise tourism- Tourism based on people travelling by small size cruise ship in among the coastal islands and tourist areas. Much of this growth is dependent upon the sector's ability to develop sustainable business models, to invest in port infrastructure and to address a variety of security concerns. An ageing population and a larger share of educated citizens will lead to more demand for 'customized experiences'.

Coastal protection/Artificial islands/Greening coastal belts

Coastal protection is different from other sectors as it is not an economic function in itself, but rather a *condition sine qua non* for the use of coastal areas and for allowing other functions to flourish. Because of its specific nature coastal protection has been defined as a separate maritime function. Important external drivers affecting the performance of this subsector are: global warming, events of erosion and/or flooding, high value economic activities in coastal regions, economical performance. Urbanization, population and economic activities concentrated in deltas and coastal regions, continues. The longer term development will be a function from three main drivers of change: 1) sea level rise and related climate change conditions 2) demographic trends and 3) economy.

Artificial islands- to reduce the demographic pressure on land, Bangladesh should adopt appropriate strategy to construct new artificial islands in our Territorial sea and EEZ allowed by the UNCLOS 1982. Sustainability of existing 75 marine islands or newly built islands must be ensured through planting salt tolerant/mangrove plants. Development of agriculture on saline soils through improving existing crops must be adopted. Desalination of sea water for fresh water usage for agriculture, irrigation, commercial use for habitant and animals of marine/offshore islands could be considered.

Greening coastal belt/delta planning- This will help reduce wind pressure of cyclones and also solidification of new lands. Mangrove in the Sunderbans comprising of 577,040 hectares provide livelihood to about 7.5 million people, timber, wood, boat building materials, rafts and garan for tanning nets, honey, wax etc including acting as spawning/breeding ground for many species. Mangrove afforestation in newly accreted intertidal areas has been going on for decades now. Bangladesh is already working for delta planning and in the long run it will help sustain agriculture, river course and intrusion saline waters etc.

Human resource, maritime surveillance and spatial planning

Human resource-Well-trained, skilled and educated human resources are the driving force of the development of an economy, who can participate in the globalization of business and the accompanying technological revolution. Dynamic and sustainable development is not possible without skilled work force. Having assessed the need of world market and local industry, appropriate courses on marine science/oceanography, ocean and coastal engineering, maritime education and trade are essential to introduce at tertiary education system. A large eligible population places Bangladesh in a suitable position to produce skilled human resources in almost any sector imaginable. A thrust in blue economic growth may come from a large army of skilled coastal and offshore engineers, navigators, merchant mariners, fisheries technologists, biotechnologists, etc. and in a variety of other professions. There are reportedly shortage of marine officers and rating worldwide and shortage escalating about 20% every year. Philippines, China and India are supplying providing most of the officers to all the merchant ships around the globes. Even Myanmar and Sri Lanka are ranked ahead of India in terms of providing ratings. Bangladesh has enormous potential for seafaring job opportunities from its 18 private and public marine academies provided it can arrange on board practical training facilities for its would be seafarer and also can remain in the white list following STCW 95. Recently the National Oceanographic Research Institute (NORI) has been established for coastal and oceanic research.

Maritime surveillance-aims to improve the situational awareness of all activities at sea impacting on maritime safety and security, the marine environment, fisheries control, trade and economic interests as well as general law enforcement and defence. Maritime safety including Search and Rescue is understood as the combination of preventive measures intended to protect shipping and port facilities against threats of intentional unlawful attacks and prevention of pollution caused by ships. There is a growing demand for all of these functions due to the increasing number of (legal and illegal) activities at sea. The last decade has seen an increase in threats, including piracy, illicit human and drug trafficking as well as terrorism.

Maritime spatial planning (MSP) - is a mechanism for the integrated management of maritime areas in which a central vision for the future of the area, in conjunction with knowledge of activity interactions and impacts, guides the location, timing, intensity and future development of all activities in the maritime space. It recognizes that seas and oceans are drivers for the economy with great potential for innovation and growth. A comprehensive understanding of the maritime environment is crucial for successful MSP, as is a thorough understanding of how maritime activities impact each other and the environment.

In conclusion it can be said that the future development potential of a Blue economy strategy for Bangladesh strongly depends on the ability of the economic actors to find a business model which fits the developmental stage and the national and global developments. However, once confidence of the future potential is established, new players can easily enter the business, invest, upscale and grow the business. Once risks subside, large industrial players (e.g. from pharmaceutical, chemical and cosmetics, but also energy, utility and mining companies) are expected to become interested in the opportunities of Blue economy. Access to finance is therefore amongst the most important barriers for the maritime economic activities in the not so developed maritime economic functions. Clearly, investment risks are substantial in this phase, but so can be the rewards. Apart from funding of activities in the development phase, access to finance can block the realization of investment plans and new business initiatives.

In light of this, it is essential that Bangladesh recognizes the true potential of its marine resources and develops an integrated maritime policy that acknowledges the inter-linkages that exist between the different domains and functions of its seas, oceans and coastal areas. The Blue Economy strategy builds on policy initiatives to recognize the potential of these marine resources and thus aids in realizing a future strategy towards smart, sustainable and inclusive growth. Our ability to compete and achieve future success in maritime economic activities, such as deep sea fishing, aquaculture, international/coastal shipping, port infrastructure, coastal and cruise tourism, offshore drilling, renewable energy, biotechnology, coastal protection, salt production, human resource for maritime activities and development of existing islands and chars will have important knock-on effects for both upstream and downstream suppliers. Successfully rolling out tomorrow's maritime economic activities will, therefore, have a positive impact on an entire portfolio of other maritime economic activities, namely those of a cross-cutting nature such as shipbuilding, blue biotechnology, drilling in the Bay and port infrastructure, human resource and maritime monitoring and surveillance.