Prospects of Blue Economy in the Indian Ocean

1. Introduction

Blue economies are gifted with specific resource endowments which could determine their course of development in future. For centuries, marine resources have served the human settlements in many different ways by providing food, energy, biodiversity, recreation and above all, the oceans, the lifelines that have the potential to absorb and regenerate. All the costal nations in the world are dependent on oceans for fishing, minerals, oil & gas, rare earth metals, renewable energy and other living and non-living resources for earning livelihood, achieving holistic growth, empowering native coastal communities and attaining greater social and economic inclusion. In that spirit, the role of blue economy which aims at optimum and sustainable use of oceanic resources for growth and development is critical for the costal nations especially for the small island developing states. Since a large portion of marine resources is believed to have remained untapped or unexplored in different marine zones of the world, there is a widespread conviction that the future source of growth is probably contingent upon the efficient utilization of those rich ocean resources. Its importance is realised prominently after the unprecedented contraction of global output and employment affecting the livelihoods of millions of people in different regions of the world. The European Union considers the vast potential of marine sectors for job creation and revival of economic activity in the member countries in the post-recession period. Moreover, for the small island developing states such as Seychelles and Mauritius the underlying growth triggers are visualised in the success of blue economy. The whole development paradigm in those countries is greatly inspired by the principles of blue economy. Even the biggest economies of the world such as the United States and China recognise the importance of enormous marine resources for economic growth, social development, restoration of environment, and protection and conservation of marine habitat. The contribution of blue economy to the overall economy has been impressive for a number of countries in the recent past with signs of robust performance in the future.

The Blue World

Indian Ocean region covers diverse areas of rich ocean cover spreading over three continents and serves as a major link for trade, investment and technology cooperation between the littoral states. The countries in the Indian Ocean region had very strong civilisational linkages manifested in maritime trade, cultural exchanges, tourism and pilgrimage, diplomatic relations and so on. Indian Ocean is a major sea route for the world connecting India, China, Far East, East Africa, South Asia and the Middle East. Given the vast endowment of oceanic resources, the littoral states representing the Indian Ocean Rim Association (IORA) countries consider the importance of harnessing blue economy for economic and social development in the region. With advancement in exploration technology, deep-sea mining could unleash huge potential for exploration of hydrocarbons, petroleum, natural gas, and rare earth metals. In addition, the demand for ports and shipping services would flourish as seaborne trade grows in the future. The rich flora and fauna attracts a large number of tourists from different parts of the world. With a focussed approach, coastal tourism and other marine services sectors may provide ample opportunities for occupational diversification and inclusive development.

There has been a continuous debate in the academic and policy circles about alternative discourses on development policies particularly after the collapse of dirigisme and greater acceptance of market mechanisms since the mid-1980s in all

important spheres of social and economic life in different communities and societies worldwide. While the brightest minds of the global development community tended to fear further perpetuation of income inequality and social deprivation in the market-led economic systems, they seem to have helplessly endorsed the current development model even though the flip sides of resource-intensive high-energy development strategies are often noticed. In this line of thinking, the costs of high growth are manifested in rapid depletion of living and non-living resource stock, severe environmental degradation, marginalization of rural and landless families, new forms of social discrimination, distorted access to social security provisions such as health and education, increasing dislocation of communities due to racial and religious civil wars, and so on. A new set of terminologies were coined to reorient the conventional development paradigm to be more people-centric and equitable which include 'sustainable development', 'green economy', 'human development', 'inclusive growth', etc. Moreover, greater concerns are voiced in favour of sustainable use of natural resources especially the rebuilding of stocks as resource use is perceived to be irreversible in the context of growth-centric development models. Following that philosophy, the oceans and the ocean-related activities are viewed as the greatest sources of growth in the post-recession period. The concept of 'blue economy' is considered as one of those vintages of development thinking.

Essentially, the principles of blue economy are similar to the kind of economic processes and activities envisaged in the 'marine economy', 'ocean economy', 'coastal economy' among others except the emphasis that it attaches to the optimum use of marine resources. Unlike green economy that propagates prevention of environmental degradation and ecological imbalance, blue economy aims at productive employment of precious oceanic resources in the development process. To a great extent, blue economy largely corresponds to the virtues of the alternative development strategies mentioned above. However, blue economy as such does not appear to be a development model itself rather it could serve as a crucial component of any other mainstream development models. Fisheries, sea-minerals such as oil & gas, ports & shipping, marine tourism, marine biotechnology, deep-sea mining, transport & logistics are some of the important sectors of blue economy. It is believed that by undertaking blue economy initiatives countries would be able to achieve high economic growth and maintain healthy balance between resource use and its renewability. For example, anecdotal estimates suggest that the contribution of blue economy (synonymously used as ocean economy) to gross domestic product for China, Indonesia and the United States is 10 per cent, 20 per cent and 1.8 per cent respectively.

Blue economy initiatives are vital to the growth of the Small Island Developing States (SIDS) as they have long coastlines and substantial jurisdiction over sea resources. SIDSs such as Seychelles and Mauritius who are members of the Indian Ocean Rim Association (IORA) have already introduced measures towards promoting blue economy as part of their

maritime strategy. The conditions for nurturing blue economy are equally conducive in many countries of the world having greater access to oceans. As the IORA member states are located along the coast of the Indian Ocean, the marine resources could be harnessed optimally for the benefit of the people of the region. Member states including Australia, South Africa and India have exhibited keenness to explore opportunities in the blue economy sectors. Among the living resources, Indian Ocean has a rich endowment of fish species contributing to food security, livelihood and foreign exchange earnings. India Ocean is also home for key marine natural resources such as oil & gas, hydrocarbons, thorium, manganese and zinc nodules, rare earth metals and other minerals. In addition, deep-sea mining in the Indian Ocean is feasible due to development of sophisticated exploration technologies in the recent years. By undertaking suitable policy measures the IORA countries may exploit the potential of blue economy for growth and development of their respective economies.

In continuation of the global debate on the role and importance of blue economy for sustainable development, a few international events were held recently in different parts of the Indian Ocean region. In August 2015, the First IORA Blue Economy Dialogue was held in the coastal town of Goa, India by the Ministry of External Affairs, Govt. of India and the two premier New Delhi-based think tanks, the Research and Information System for Developing Countries (RIS) and the Observer Research Foundation (ORF). Experts drawn from diverse fields of blue economy representing the IORA countries and from other parts of the world contributed to the deliberations on different academic and policy perspectives relating to the prospects of blue economy in the Indian Ocean region. The outcome of the deliberations was formally released in the name of 'Goa Declaration' by the conference organisers. This Dialogue was followed by the First IORA Ministerial Blue Economy Conference organised by the IORA Secretariat in Mauritius during 2-3 September 2015 and the 2nd Indian Ocean Dialogue held in Perth, Australia in September 2015. All the three conferences focused on several key areas of blue economy ranging from accounting framework, fisheries & aquaculture, renewable ocean energy, seaports & shipping, seabed exploration & minerals, and mineral services. Besides highlighting the sectoral priorities and policy measures, the need for a comprehensive accounting framework for measuring blue economy was endorsed by the conference participants. In addition, the IORA Women's Economic Empowerment event held in Seychelles highlighted the good practices and solutions related to women's empowerment and entrepreneurship in blue economy in Seychelles. These events seem to have spread adequate awareness among the various stakeholders of blue economy in the Indian Ocean region, and aroused interests among the academics and policy makers for pursuing this subject in future.

Against this backdrop, this Report presents the synthesis of various conceptual and methodological issues relating to blue economy and the importance of this paradigm to the overall

social and economic progress of the IORA countries. Since there exist ambiguities over the coverage of blue economy sectors and data availability, empirical estimates of the size of blue economy and related indicators are avoided here.

2. Definitions of Blue Economy

The concept of blue economy is still at an evolving stage where there is yet to be any comprehensive definition which would be appropriate from the operational point of view. In the literature, blue economy has been used synonymous to 'marine economy', coastal economy', ocean economy', 'green economy' and so on. While the basic tenets and goals of these competing paradigms are more or less similar, there are basic differences in the approaches and treatment of various elements such as resource management, growth objectives, sustainability and social equality. At the United Nations Conference on Sustainable Development held in Rio de Janeiro in 2012, blue economy was viewed as ocean economy that aims at the "improvement of human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. At its core the ocean economy refers to the de-coupling of socio-economic development from environmental degradation. In this regard, efficiency and optimisation of natural marine resources within ecological limits becomes paramount" (UNCTAD, 2014). By that definition, ocean economy can be defined as the economic activity which directly or indirectly uses the sea as an input whereas the coastal economy represents all economic activity which takes place in a specific coastal region (Morrissey et al, 2010).

To understand the 'ocean economy', one has to understand its features as follows. Ocean economy (1) a sub-set of the economy (2) dependent on ocean for inputs to invigorate its production process (3) based on industry and also geographical locations and (4) these industries/activities are located in coastal and non-coastal areas. According to Colgan (2004), "the *ocean economy* is that proportion of the economy which relies on the ocean as an input to the production process or which, by virtue of geographical location, taking place on or under the ocean. It is a function of both industry and geography … While most of the ocean economy (for example, boat building, seafood retailers and many ocean instrumentation, equipment and surveying industries) may be located in non-coastal region".

In terms of volume of activities, the 'costal economy' is larger than 'ocean economy'. The basic features of the coastal economy are: (1) a sub-set of the economy (2) concentration of activities on or around the coastal areas and (3) sum of all activities relating to output, employment and wages in the coastal region. Therefore, Colgan (2004) has defined costal economy as "..... all economic activity in the coastal region, and is thus the sum of employment, wages, and output in the region. Some of the coastal economy is the ocean economy, but the coastal economy incorporates a broader set of economic activities".

The 'marine economy' is a horizontally integrated cluster industries which include sectors meant for a common market for the end products, using common technology or labour force skills, or require similar natural resources

(University of Massachusetts, 2006). This sector comprises of five major sectors including commercial seafood, marine transportation, coastal tourism and recreation, marine science and technology, marine-related construction and infrastructure. The marine economy is a sub-set of the coastal economy.

The Government of Australia in its report titled 'Marine Nation 2025: Marine Science to Support Australia's Blue Economy' defines that "a blue economy is one in which our ocean ecosystems bring economic and social benefits that are efficient, equitable and sustainable" (Govt. of Australia, 2013). In same line of thinking, EIU (2015a) summarises the concept and objectives of blue economy with clarity. It says national ocean development strategies refer blue economy as a guiding principle. And, blue economy is synonymous to "greening of the ocean economy". Extending this further, as per the UN Summit the horizon of blue economy is much wider and inclusive. It has futuristic development implications by visualising certain patterns of production and consumption of ocean resources.

Fishing Activities in Coastal Region

UN in its concept paper is of the view that blue economy conceptualises ocean economy as development spaces. From this perspective, blue economy should break the mould of business-as-usual 'brown' development model where oceans are perceived as a means of free resource extraction and waste dumping without taking into account the costs of the negative externalities. This strand of thinking signals the inherent risks involved in indiscriminate exploitation of marine resources for economic growth. Further, resource accounting should take into cognisance the costs of environmental damage and ecological imbalance caused due to consumption-centric resource use (Pauli, 2010). The European Commission (2012) has defined the concept of blue economy as "all economic activities related to the oceans, seas and coasts. This include the closest direct and indirect supporting activities necessary for the functioning of these economic sectors, which can be located anywhere, including in landlocked countries".

The growing competition among the nations for energy and resources focuses the need for regional cooperation

Courtesy: http://www.dnv.com/binaries/

Key Ocean Activity

Table 1: Taxonomy of Blue Economy Sectors and Activities	
Sector	**Activity**
Fishing	Capture fishery, Aquaculture, seafood processing
Marine Biotechnology	Pharmaceuticals, chemicals, seaweed harvesting, seaweed products, marine derived bio-products
Minerals	Oil and gas, deep-sea mining (exploration of rare earth metals, hydrocarbon,
Marine Renewable Energy	Offshore wind energy production, wave energy production, tidal energy production
Marine manufacturing	Boat manufacturing, sail making, net manufacturing, boat and ship repair, marine instrumentation, aquaculture technology, water construction, marine industrial engineering
Shipping, Port & Maritime Logistics	Ship building and repairing, ship owners and operators, shipping agents and brokers, ship management, liner and port agents, port companies, ship suppliers, container shipping services, stevedores, roll-on roll-off operators, custom clearance, freight forwarders, safety and training
Marine Tourism & Leisure	Sea angling from boats, sea angling from the shore, sailing at sea, boating at sea, water skiing, jet skiing, surfing, sail boarding, sea kayaking, scuba diving, swimming in the sea, bird watching in coastal areas, whale/dolphin watching, visiting coastal natural reserves, trips to the beach, seaside and islands
Marine Construction	Marine construction and engineering
Marine Commerce	Marine financial services, marine legal services, marine insurance, ship finance & related services, charterers, media & publishing
Marine ICT	Marine engineering consultancy, meteorological consultancy, environmental consultancy, hydro-survey consultancy, project management consultancy, ICT solutions, geo-informatics services, yacht design, submarine telecom,
Education and research	Education and training, R&D

Sources: Compiled from Morrissey et al. (2010), EIU (2015a), Govt. of Ireland (2012) and Marine Institute (2005).

to harness the endowments in a more sustainable manner. Adoption of a comprehensive definition of the blue economy is necessary to understand and to act jointly to harness the existing potential of blue economy in the IORA region. However, the blue economy and other related concepts may be comprehensively defined as the following:

As a segment of an economy, *Ocean economy* is dependent on ocean for inputs to run certain production processes in the coastal and non-coastal regions, and these activities are identified by both industry and geographical location.

As a sub-sector of an economy, *Coastal economy* includes all economic activities including the sum of output, employment and wages, taking place on or near coast.

As a sub-set of the economy, *blue economy* covers all ocean related activities including direct and indirect supporting activities required for functioning of these economic sectors, while adjusting to the costs of environmental damage and ecological imbalance caused due to exploitation of ocean resources for consumption. Therefore, the scope of blue economy is much wider and inclusive.

The concept of blue economy is subject to multiple interpretations because of the coverage of activities, geographical locations and sectors. From the available literature, an indicative list of sectors and the activities fall in those sectors are illustrated in Table 1. While some studies classify different sectors of blue economy into traditional and emerging sectors, there is hardly any common position on this view.

In this context, Table 2 presents data on the size of blue economy in select countries. Since the conception and methodology differs across the sources, these numbers are indicative only. Going by the figures shown in Table 2, promoting

Table 2: National Estimates of Blue Economy

Country	Size of Blue Economy			Indicative Employment	
	Year	Output (US$ Billion)	% of GDP	Year	No.
Australia	2004	17.00	3.6	-	-
Canada	2004	15.98	1.5	2006	1,71,365
France	2006	16.69	1.4	2009	4,59,358
New Zealand	2006	2.14	2.0	-	-
United Kingdom	2008	84.27	4.2	2006	5,48,674
United States	2009	138.0	1.2	2010	2,770,000
China	2010	239.09	4.0	2010	9,253,000
Ireland	2007	1.9	1.0	2007	17,000

Sources: Compiled from Colgan and Kildow (2013); Zhao et al. (2013).

Notes: Data for size of blue economy are from Colgan and Kildow (2013). For China and Ireland, value added figures are drawn from Zhao et al (2013). Data on employment are based on Zhao et al (2013).

blue economy is socially desirable as the magnitude of job creation is substantial.

Recent cross-country evidences show that blue economy is emerging as a dynamic component of some economies, thus generating interest for its comprehensive development through formulating national policies, evolving strategies at the national level and arousing debate in the global platform to highlight the importance of the issue and initiative global plan of action to focus on ocean and other related activities.

3. Importance of Blue Economy: Key Economic Issues

There are several good reasons to pursue with the regional agenda of blue economy which is gaining ground in the Indian Ocean region. Several regional economies have linked health of their economies with the health of the planet and have understood that their fates are thoroughly linked with the state of health of the ocean. In this regard, the region's economic and strategic interests are intricately linked to ocean economy as the region is dependent on ocean for critical issues including food security, livelihood security, minerals, energy security, industrial activities and various key services activities. As several Member countries are aspiring to have close economic regional cooperation at the sectoral level, there is clear convergence of interest between these countries to understand the nature of blue economy and to initiate multi-layer cooperation between them in the region. Following Rio+20 conference in 2012, it emerged prominently about the independent development thinking regarding the blue economy without seeing it as a rejoinder to the sustainable development agenda. It becomes a challenge to the member countries to take recourse to immediate policy action in order to take advantage of the opportunities offered by the blue economy. Some of the opportunities provided by the blue economy are briefly discussed below to highlight its relevance.

3.1 Food Security

Blue economy has a major role in securing food security for the people. The fisheries sector including aquaculture and aquatic plants, contributes sizable proteins, fats and calories supply which supports food security situation in a country. Ensuring food security requires improved access to nutritious food of both animal and non-animal origin, reduction of food wastage, low barriers to trade in food and food products, and provision of efficient distribution of food items in food-deficient regions. In addition to the conventional measures of addressing food insecurity, blue economy offers ample opportunities to meet the growing demand for healthy and safe food by enhancing marine fishing. A good number of finfish and shellfish varieties in raw as well as processed forms are used as seafood worldwide. Fishing areas in the Indian Ocean region represent a rich endowment of fishery resources. Persistence in the decline of catch fish has been a major concern for the world economy. However, the biological stocks of many of those species are depleting due to overfishing and illegal, unreported and unregulated (IUU) fishing. Since capture fish landing faces stagnancy the dependence on marine aquaculture (also termed as mariculture) for fish supply has grown significantly in the recent years. Fishing nations in the region

Fish as a Major Source of Food Security

have taken necessary steps to promote aquaculture which helped them meet domestic demand for fish and export to other markets. The contribution of fishery sector to food security can be enhanced by adopting blue economy policies in the regional economies.

In the context of blue economy, higher fish production with lower environmental damage is possible through polyculture, specie diversification, optimal feeds and feeding, prevention of diseases and so on. Moreover, countries embracing blue economy would focus more on developing sophisticated technologies for farming, conservation and processing of species. The role of small-scale aquaculture by the native fishing communities is paramount from the perspective of food security. After meeting the household demand for fish for subsistence, the local fishermen would be able to earn their livelihood by selling surplus fish in the urban markets. Further, by having enabling policies on pricing, certification, labelling and marketing, the fishing sector in the context of blue economy can be more organised and regulated.

3.2 Demand for Protein

Demand for protein can be effectively addressed by the blue economy. For a healthy life, humans need balanced diet comprising of proteins, fats and other essential ingredients.[1] A minimum amount of protein intake is required in that food basket as it helps maintain the average

[1] For feature of balanced diet, see http://www.who.int/mediacentre/factsheets/fs394/en/.

daily calorie requirements in human body. Fish is a crucial source of animal protein even in countries where the daily average per capita fish consumption is low compared to developed fish-consuming nations. Fish in small quantities can have significant nutritional impact as it is a concentrated source of protein and contains essential fatty acids and micronutrients.[2] Fish and fish products are sources of three different types of animal proteins that are vital to human health. Structural proteins comprising of actin, myosin, tropormyosin and actomyosin constitute 70-80 per cent of the total fish protein. In addition, sarcoplasmic proteins such as myoalbumin, globulin and enzymes and connective tissue proteins account for approximately 25-30 per cent and 3 per cent of total fish protein respectively.[3] It is also the most affordable source of animal protein in absence of any alternative sources of protein. Fish contributes more than 50 per cent of total protein supply in SIDSs and many other countries of the world. For some IORA countries such as Indonesia, Bangladesh and Sri Lanka the share of fish in total animal protein is 54 per cent, 56 per cent and 57 per cent respectively (FAO, 2014). In 2010, fish accounted for 19.6 per cent of animal protein intake in the developing countries. In other words, fish and fish products provided 2.9 million people with almost 20 per cent of their intake of animal protein and 4.3 billion people with about 15 per cent of animal protein. As per an estimate, 150g of fish

Courtesy: http://www.nutritionstyle.net/best-fish-to-eat-while-on-a-diet/

Fish as a Source of Protein

[2] FAO (2014).

[3] FAO (http://www.fao.org/fishery/topic/14869/en).

yields about 50-60 per cent of an adult's daily protein requirement. Interesting revelations on food consumption habits in different parts of the world indicate that animal protein is no more considered as a luxury food rather it is increasingly being accepted as an essential part of the regular diet. Moreover, consumers in low-income countries tend to diversify their food basket towards more protein and fat containing food such as meat and fish (Regmi and Meade, 2013).

The statistics mentioned above hint at the importance of adequate and sustained supply of high quality fish in order to meet the average protein requirements. Although increasing fish production has been the underlying policy priority in most countries of the IORA region, the focussed approach to deal with the issues of nutrition and health using marine fishery resources in the blue economy paradigm would enhance the contribution of fish to animal protein supply in the regional economies. Both freshwater farming and mariculture of protein-rich species should be encouraged in the countries promoting blue economy in the region. Focused blue economy policies for aquatic sector would not only promote production, trade and food security situation in the economy but also to address the protein requirements of people in the IORA region.

3.3 Rising Coastal Tourism

Coastal tourism, a major sector of blue economy, presents huge potential for job creation and economic growth. Experiences of littoral countries indicate that costal tourism goes hand in hand with global tourism. In 2015, the world tourism sector is estimated to grow by 3.7 per cent and employ 283,983 people. Tourism activities shrank drastically during 2007-09 due to the global economic recession. However, the sector revived strongly by registering an average growth rate of 3.3 per cent over the period 2010-15. At present, the size of tourism sector is US$7,863.5 billion which accounts for 9.9 per cent of world GDP.[4] Leisure tourism spending constitutes a little more than 50 per cent of the total tourism output. For the IORA region as a whole (except Somalia) the tourism sector in 2015 turns out to be US$670 billion representing 8.5 per cent of world tourism industry. Besides the overall role of the tourism sector, the importance of marine or coastal tourism is relatively higher for a successful blue economy. UNEP (2009) observes that growth of coastal tourism has reached its peak in recent decades. In the EU, this segment is counted in the EU's Blue Growth Strategy as a sector with special potential to foster smart, sustainable and inclusive Europe. It is the biggest maritime sector in terms of gross value added and employment generation.[5] In countries like Ireland, the water-based tourism and leisure industry is quite substantial in terms of value addition and diversification. It is an outcome of a set of concerted policy measures that addresses the potential and the constraints in promoting the marine tourism sector. Sea angling, bird watching, boating at sea, dolphin watching, scuba

[4] Based on data from World Travel and Tourism Council (http://www.wttc.org/datagateway/).

[5] http://ec.europa.eu/maritimeaffairs/policy/coastal_tourism/index_en.htm

Coastal Tourism: Untapped Opportunities

diving, swimming in the sea and other related activities around the sea are some of those emerging segments of coastal tourism.[6] Hotels, motels, water sport, cruise and restaurants are potential segments for expansion and growth in the coastal tourism sector. The flora and fauna spreading over the littoral states of the Indian Ocean provides biggest opportunities for investment in the tourism sector which in turn would contribute to more robust blue economy in the region. At the same time, the adverse effects of expanded tourism activities have to be monitored regularly to optimise welfare effects stemming from the coastal tourism sector.

3.4 Surging of Seaborne Trade

Sea is a cost-effective and carbon-friendly mode of transportation for global trade. About 90 per cent of world trade is conducted through the sea routes. Advances in technology improved efficiency of shipping and contributed to the sustained rise in the world seaborne trade. About 50,000 merchant ships including container ships, bulk carriers, ferries and cruise ships are engaged in international trade.[7] International

[6] See Morrissey et al (2010).

[7] International Chamber of Shipping (http://www.ics-shipping.org/shipping-facts/shipping-and-world-trade).

Courtesy: http://www.libraworldwide.com/international-shipping-logistics-services/

Seaborne Trade: A Traditional Mode of Commerce

seaborne trade continued to grow at a steady rate over the past few years after a sharp contraction in activities during the global economic recession. In 2009, total cargo handled through sea dropped drastically by 4.5 per cent to 7,858 million ton from 8,229 million ton in the previous year. Since recovery from recession in major economies is fragile, seaborne trade may take time to bounce back in the next few years.[8] As per the latest reported data (2013), the size of seaborne trade is approximately 9,600 million ton. Dry cargo accounts for more than 70 per cent of the total volume of seaborne trade in the world. These include trade in bulk commodities such as iron ore, coal, grain, bauxite, alumina, phosphate rock, containerized trade and general cargo.

Although large part of the growth in trade by sea is explained by rapid industrialisation and liberalization of trade policies in most countries of the world, the main triggers for seaborne trade has come from increasing demand for imports of raw materials, resources, etc by China, India and other Asian economies. In addition, the pace of urbanisation and competitive international ore prices would support growth in the major dry bulk cargo sector. Potential for additional

[8] UNCTAD (2014).

capacity creation and demand for refined petroleum products will be triggered by the increasing requirements in developing Asia and America. Likewise, additional supply capacity in the Asia-Pacific and the United States and new fields in the Caspian region would help LNG shipments to rise in the coming years. Coal trade is also expected to grow in the future. These developments signal a great potential for blue economy to deliver in the Indian Ocean region. More than two-thirds of global seaborne trade are routed through the Indian Ocean. The IORA states are not only the active participants of this flourishing segment of world trade but also the major suppliers of port and shipping services in the region. Some of the IORA countries are major producers, users and exporters of iron ore, coal, steel and grain in the world. As emphasized before, in the blue economy framework, ocean-based activities get relatively higher attention than its absence. The priorities and policy measures towards promoting trade by sea route may be more systematic, target-oriented and futuristic. For example, the demand for imports of resources from Africa would facilitate two-way mutually beneficial trade between China, India, the African countries and others as both the parties would be keen to invest in blue economy sectors.

3.5 Demand for Alternative Sources of Energy

Blue economy could be a major source of clean energy, where large renewable energy is not tapped. Where world economy is aspiring for clean, renewable and affordable energy supply, the blue economy is emerging as a large reservoir of such energy. The ever-increasing demand for energy for the purposes of household and industrial consumption in most parts of the world especially in India, China, Brazil and other emerging markets necessitates alternative sources of energy, most importantly the renewable energy. As per the estimates by the International Energy Agency, in the next 15 years the global primary energy demand would grow by 40 per cent; a substantial chunk of that would come from developing Asia and the Middle East. The renewable energy market is growing in a good number of non-OECD countries which signal the potential of this sector from the perspective of blue economy. Resources under the blue economy initiatives can be suitably employed for development and promotion of renewable energy technologies. For instance, solar PV and wind in India; non-hydro renewables in Brazil, Egypt, Thailand and the Middle East; hydropower in Asian countries and others indicate the achievements in the renewable energy sector.[9]

Ocean renewable energy in the form of wave energy, solar energy, tidal energy, hydroelectric energy would reduce the burden on finite conventional sources of energy production. Renewables account for the net additions to power capacity in many developing countries. In this context, the role of fossil fuel would remain crucial for China, India, Brazil and other developing countries for expansion of the

[9] IEA (2015).

Future Source of Energy

renewable energy sector. The Government of India has set measurable targets for four key sectors of renewable energy such as wind power, solar power, biomass power and small hydro power in its Strategic Plan for New and Renewable Energy Sector 2011-17.[10] Interestingly, the global average cost of energy production for wind and solar PV has fallen considerably in the recent years. Further, with projected fall in the cost of production in the future, renewable energy would meet a lion's share of energy demand in the IORA region. In fact, many littoral countries are dependent on blue economy for the supply of hydrocarbon including India. However, by using the cleaner and environment-friendly ocean energy technologies larger goals of the blue economy paradigm could be achieved.

[10] Govt. of India (2011).

Courtesy: https://www.google.co.in/

Surging Urbanisation in Coastal Areas

3.6 Managing Coastal Urbanisation

In several littoral countries, fast growth of urbanisation along the coast line is the contribution of the blue economy paradigm. However, uncontrolled rise of urbanisation has detrimental impact on the economy. From different perspectives, urbanization should be considered as a positive logical transition for a country along the development path. However, unplanned urbanisation in different parts of the world have caused serious damage to the living habitat, land use pattern, spatial congestion due to migration from rural areas, spread of slums, heath risks arising from poor solid waste management and a variety of governance challenges. As a result, urbanisation invites more negative connotations than positive ones in the contemporary literature for the developing and less developed countries.[11]

However, blue economy policies seem to have more positive propositions in favour of urbanisation. In precise terms, promoting coastal urbanisation by subscribing to the core principles of sustainable, low-carbon and eco-

[11] IOC/UNESCO, IMO, FAO, UNDP (2011) present disturbing facts relating to coastal megacities in the world and the challenges it throws for blue economy.

friendly processes and technologies would eliminate the established fears associated with the business-as-usual approach toward city planning. There is a need to switch from production-led urbanisation to tourism-led urbanisation in which a city would rather serve as a space for consumption and leisure than for production.[12] In the blue economy framework, coastal cities can be viewed as a source of economic dynamism, agglomeration of blue activities, social empowerment of resource-dependent local communities and pollution-free built-in environment.[13] IORA countries must seize the opportunities in the coastal cities by investing in new blue cities or revamping the old coastal cities.

3.7 Improving Ocean Health

With very little dispute, it is a fact that the oceans and the oceanic resources face the risk of extinction and secular depletion due to the rapid industrialisation, unplanned and poorly governed urbanisation, sea encroachments, water pollution, soil degradation, climate change and many other factors. As a result, the quality of marine biodiversity is getting eroded day-by-day without commensurate compensating mechanisms in place. Oceans serve as the biggest sink whereas the importance of its resources for the very sustenance of the mankind is undermined. Greenhouse gases would raise the temperature, chemistry, structure and height of the oceans which in turn would affect the ability of marine organisms to survive, the ability of the populations to persist, the evolution of species and the interaction between species. It may require calibrated policy initiatives representing a mix of identification of vulnerable species, marine protected areas, ecosystem-based management, effective fisheries regulations and so on.[14]

Likewise, other pollutants deteriorate ecological balance and lower the degree of natural and biological resilience to such environmental threats. As envisaged in its principles, blue economy approach would contribute to the process of restoring the ocean health and its precious resources. It is observed that investment in coastal habitat restoration projects stimulates job creation, rebuilds fisheries, revives coastal tourism, raises property values, and improves water quality.[15] This has greater relevance for the IORA countries as the marine space covered under its jurisdiction is quite large for blue economy to show tangible gains. It is likely that countries adopting blue economy would have elaborate schemes for conservation and protection of the living and non-living resources. For fisheries, the role of regional fishery organisations may assume renewed importance in the context of blue economy. Similarly, for non-living seabed resources, the policies, regulations and enforcement mechanism by the

[12] Qian et al (2012) present case studies of tourism –driven urbanisation in Guangdong province in China and document the distinctness of this approach for local socio-economic development.

[13] Beall et al (2008) discuss the multidisciplinary perspective on urbanisation and development. To them, urbanisation in a broader sense serves the purpose of development.

[14] For further details, see Pinsky et al (2013).

[15] See Edwards et al (2013).

Conservation of Marine Habitat

International Seabed Authority and other international maritime organisations can be effectively used once blue economy goals are seriously pursed in the Indian Ocean region.

3.8 Providing Marine Governance

The potential of marine resources for socio-economic development depends on the effectiveness of marine governance both at the national and the global level. It refers to the provisions, regulations and mechanisms surrounding access, management and control of oceans, ocean resources and the ocean-related activities. In many different forms, marine governance is an integral component of a plethora of international and multilateral conventions on sea. In addition, some regional mechanisms such as regional fishery management organisations, regional inter-governmental maritime cooperation organisations and others also cater to various aspects of marine resource governance. Among the international organisations, the UN Convention on Law of the Sea which came into force in 1994 has been viewed as the most comprehensive single piece of legislation with membership of more than 150 countries of the world. In addition, a number of mechanisms in the form of conventions and agreements on fisheries are facilitated by the Food and Agriculture Organisation and other sister UN bodies.

While provisions and mandates of some of those mechanisms, national as well as international, are binding, most of them are advisory in nature, thereby no penalty for violations. Although many of those difficulties would continue to complicate marine governance in countries adopting blue economy, one could hope for a much better and compliant governance regime once measures towards blue economy gather momentum. Moreover, coastal countries may require formalisation of certain regional and global governance and regulatory practices for the success of blue economy in the future.

3.9 Ocean Technologies

Ocean technologies correspond to technologies used for renewable energy production, deep-sea mining, freshwater production from sea, offshore structural components, ocean acoustics, seabed classification, modelling of oceanic processes, ocean electronics, marine biotechnology, aquaculture, coastal and environmental engineering, among others. The potential of those technologies are vast in terms of their future contribution to energy supply, production process, drug development, seabed management, and so on. The development of ocean technologies may get more attention in coastal economies pursing blue economy. In conventional policies for oceans, the nature of resource allocation and the mindset delay the process of implementation, sometimes leading to project closure. Since technology and innovation are key

Offshore Renewable Energy

drivers of blue growth, the countries following blue economy may devote more resources to develop those technologies and institute mechanisms for long-term pursuit of scientific knowledge in those areas. Almost all the IORA countries have shown interest in promoting blue economy in the coming years in a very big way. Since energy demand is growing in most of the IORA countries, the search for innovative technologies for renewable energy production would remain supreme. At the same time, marine biotechnology has better prospects in the IORA region. The need for new formulations and compounds would invite fresh investments into the sector. Blue economy in the IORA region would need ocean technologies, and therefore will undertake necessary steps to develop such technologies in the emerging sectors.

As highlighted above, blue economy encompasses a wide range of sectors that could address key developmental challenges facing the coastal economies. By harnessing blue resources, the issues of poverty, food insecurity, unemployment and ecological imbalance can be effectively tackled. Research and innovations in marine biotechnology, higher access to seabed resources, investment in marine ICT and proper integration of costal tourism and other services could play a crucial role in injecting stimulus for creating additional economic activities in the IORA region.

4. Guiding Principles of Blue Economy

Considering the plethora of issues, the principles and goals of blue economy are quite ambitious. At present, global experience in implementing policy initiatives for blue economy is scant and varied. In order to develop a holistic stand on the definition and measurement of blue economy, it is imperative to highlight the key crucial elements of blue economy at the global as well as the national level. It would help facilitate a systematic effort towards kick-starting blue economy in the Indian Ocean region and building capacity in other countries for suitable replication and adaptation.

4.1 Efficient Utilization of Marine Resources

Optimum and efficient utilization of marine resources is at the core of blue economy which is not so explicitly emphasized in green economy philosophy although ocean economy is solely meant for the use of ocean resources. Basically, blueing of economies would facilitate greater use of untapped marine resources in a much bigger way which, in turn, may raise the contribution of oceans to the overall economy.[16] As claimed by the protagonists of blue economy, the contemporary development strategies focussed more on maximum use of oceanic resources with little concern for renewability and rebuilding. As a result, the economic cost of losses resulting from

[16] "To quote from European Marine Board (2015), ".....every second specimen collected from abyssal waters deeper than 3000m belonged to a previously undescribed species".

depletion of natural and biological stock is believed to have increased significantly. If these losses are factored into national income accounting, the net income from marine resources could be lower. Unlike those approaches, blue economy turns its focus from 'maximum' to 'optimum' use thereby envisages 'sustainable use' corresponding to the long-term stock of resources.

4.2 Exploiting Opportunities in Emerging Marine Industries

Although marine industries have contributions to the economy of the coastal economies even in absence of any specific policies for blue economy, the importance of marine industries is higher in the blue economy framework. Instead of benefiting from the use of available marine resources and technologies, blue economy paradigm may enable fresh investments in R&D and technology development that could help explore new marine resources. This, in turn, would facilitate emergence of new marine industries and expand activities in the economy. Marine biotechnology, marine ICT, tourism and leisure are some of the sunrise blue economy sectors which are considered to have potential for accelerated growth. New drugs are being developed from marine organisms which may be highly useful for certain critical diseases. Further research on marine organisms could shed more light on the opportunities in the biotechnology sector in the future. Telephone cables, gas pipelines, energy corridors and intensive engagement among the regional countries would require greater application of information technology in the coming years. Likewise, blue economy initiatives could diversify the marine services sectors particularly transport and tourism.

4.3 Inclusive and Harmonious Growth with Sustainability Concerns

The concern for sustainability of resources is not new in the development literature. 'Green economy' philosophy is based on the idea of controlling environmental pollution caused in the process of development. Unlike green economy, blue economy blends both the objectives of optimum use and preventing misuse or wasteful use of marine resources.[17] Also, blue economy sounds more appealing compared to green economy as the possibility of expanding production frontier is relatively high in case of the former. In other words, blue economy paradigm not only emphasizes upon the protection and rebuilding of marine resources rather it advocates higher use of precious oceanic resources which perhaps remain underutilized so far. Except maximising economic growth, the weight given to sustainability in the blue economy paradigm has connotations for inclusive growth as well. Following the conventional thinking, the oceans were treated as the greatest sink of all industrial and human wastes. Whatever efforts were directed towards preventing marine pollution and degradation of ocean habitat in the past, those efforts were basically corrective in nature without

[17] For details about opportunities in the blue economy sectors and the desired sustainable practices corresponding to those sectors, see EIU (2015b).

any thinking for switching to alternative development strategies. Blue economy apparently incorporates both these canons of sustainable and inclusive development.

4.4 Creating Legal and Regulatory Institutions

As per the existing international maritime regimes, coastal countries have jurisdiction to fisheries, minerals and other marine resources within their respective Exclusive Economic Zones (EEZs). Resources in the deep-sea are governed in accordance with the provisions of certain international conventions such as the United Nations Convention in the Law of the Sea (UNCLOS), conventions of International Maritime Organization (IMO), International Seabed Authority (ISA) and regional and global institutions of the Food and Agriculture Organization (FAO). Since the guidelines of these conventions are largely advisory in nature, there is enough room for breach of territorial jurisdictions in high seas by any country regardless of its membership to those conventions. As a result, disputes are likely if aggressive maritime strategies are followed by the competing world powers in the Indian Ocean Region. In case of fisheries, dealing with the migratory species is a very contentious issue. There are some regional fisheries management organizations like the Indian Ocean Tuna Commission (IOTC), International Commission for the Conservation of Atlantic Tunas (ICCAT), Western and Central Pacific Fisheries Commission (WCPFC) and so on. Some of those fishing organisations have binding rules and regulations whereas most of those are advisory. Similarly, deep-sea exploration is regulated by the licenses issued by the ISA. Despite ISA regulations, there are instances of violations of areas allotted for deep-sea mining.

As blue economy envisages intensification of activities in and around the oceans, the likelihood of frequent territorial disputes relating to use and misuse of marine resources cannot be undermined. It, therefore, requires either creation or streamlining of the current institutional arrangements governing the access, use and protection of maritime resources.

5. Elements of Blue Economy

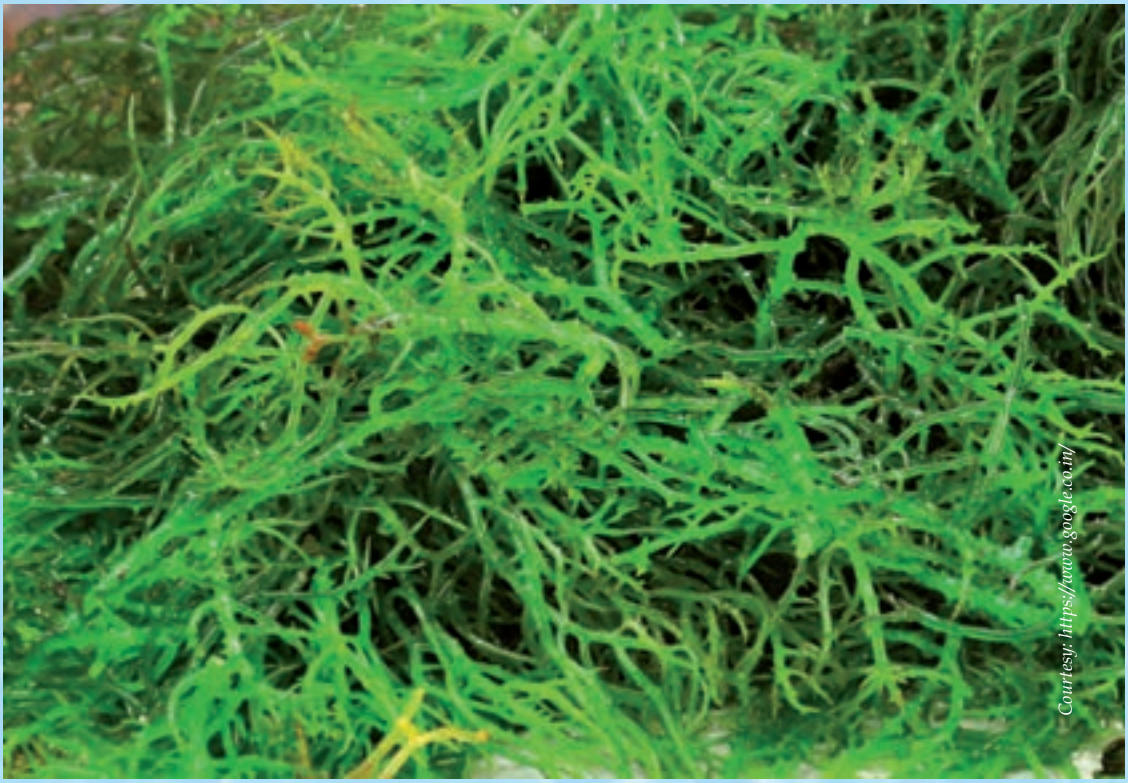
The blue economy paradigm puts emphasis on the term 'blue' which primarily refers to water. In that perspective, the coverage of blue economy can be expanded to all water-bodies and water-related activities over the land and in the seas within the sovereign jurisdiction of a country. Logically, the whole range of activities involving fresh as well as marine water would comprise blue economy for any typical economy. However, this argument does not seem consistent with the position maintained in the current literature. Broadly speaking, there is some agreement over the inclusion of marine sectors and its related activities in the blue economy. None of the studies mentions about inclusion of activities in freshwater as part of blue economy. On the contrary, ocean and ocean-related activities have been the core of blue economy. It is commonly believed that ocean and ocean-related activities are mostly related to maritime trade, fisheries and aquaculture, and a few other activities, but blue economy activities are deeply entrenched into

almost all sectors of an economy. In fact, there is no such major sector which is excluded from the activities of the blue economy.

The structure of the blue economy is very similar to national income, but there are differences in terms of inclusion and exclusion of specific sectors/industries in the estimation process. In terms of industries engaged in production activities, nearly 15 per cent of disaggregated industries is falling under the domain of blue economy. Unlike the national income accounting, blue economy activities are not only determined through the associate industries but by their geographical locations. The bulk of economic activities related to the blue economy takes place in the coastal area. Therefore, accounting system of blue economy is different from that of national income estimation. Different country studies show that the blue economy grows faster than the rest of the economy, thus, the latter has high growth potential in future. The key sub-sectors of the major economic sectors in an economy, exhibiting dynamism of blue economy, are briefly discussed.

5.1 Agriculture

Agriculture is a crucial sector of blue economy for any country in the world. In the context of blue economy, agriculture refers to fisheries and aquaculture. This sector contributes significantly to food, nutrition, livelihood security, job creation and foreign exchange earnings. While overall



Seaweeds: Changing Food Habits

stagnancy was observed in capture fishery for the past few decades, aquaculture witnessed dramatic growth in these years. Fishery is considered as an important traditional sector whereas aquaculture is counted among the emerging sectors of blue economy. However, as mentioned above, the inclusion of inland fishery resources in blue economy remains a debatable issue. Besides fishery, all other aquatic resources including aquatic plants should ideally form part of blue economy. However, in some countries aquatic plants are not covered in blue economy. Moreover, agricultural crops will have to be considered if freshwater is added to the coverage of blue economy. All these issues are quite contentious at present at least from the point of empirical measure of the contribution of the sector to national output.

5.2 Mining

Oceans are a rich treasure of oil, natural gas, minerals including hydrocarbons, rare earth metals, zinc, manganese noodles and other oceanic resources on the seabed. Deep-sea mining is viewed as a potential sector for promotion of blue economy. Most of the studies have considered oceanic minerals and offshore mining as the major blue economy sectors. However, the coverage of mining sector differs from country to country based on the respective national statistical systems. In addition, the distinction between mining in the land and mining in the seas in certain sectors is not known. In that case, the potential and performance of that sector would be underestimated. Exploration of seabed resources requires permission of the International Seabed Authority (ISA). Countries are allowed to do exploration

Offshore Oceanic Resources: Unleashing Potential of Seabed Resources

only in their allocated areas on the seabed. Since the race for deep-sea mining has already begun, international regulations pertaining to the sustainable harnessing of seabed minerals need to be compatible with the changing environment. Once blue economy takes off in most countries of the world, the disputes over access to minerals outside the EEZs may rise in the future.

5.3 Industry

Marine manufacturing, electricity generation from offshore sources, gas and water constitute the industrial sectors of blue economy. Marine manufacturing sector covers a wide range of activities such as boat manufacturing, sail making, net manufacturing, boat and ship repair, marine instrumentation, aquaculture technology, water construction, marine industrial engineering, and so on. This list of activities is exhaustive and encompasses several manufacturing sectors. Since blue economy is evolving in different parts of the world the activities that are emerging in marine manufacturing vary across the countries. For instance, the demand for new ship building would grow as the seaborne trade expands. Likewise, new shipping technologies would require replacement of old ships thereby providing further impetus to ship manufacturing industry. Along with shipping marine industrial engineering sectors would also grow. The industry

Ship Repairing Services: Creating Jobs

would demand technicians and trained marine engineers for manufacturing and repair of ship, machinery, etc.

5.4 Services

While the contribution of services sectors in general is rising for most of the countries of the world, marine services segment exhibit significant potential for growth in the future. In the context of blue economy these sectors assume higher importance. As the magnitude of investment is expected to rise in view of increasing blue economy orientation in the coastal countries, in-depth analysis of the potential and prospects of marine services is important. Major services sectors include ports & shipping, tourism, banking and financial services, transport & logistics, marine commerce, ICT and others. In the tourism sector, leisure cruise, coastal tourism, bird watching, angling, fishing and other related services have huge potential for wage-employment in local areas and foreign exchange earnings. As blue economy policies are implemented fully, the need for project financing, term financing and brokerage services would grow. This, in turn, would require a deep marine banking

Cruise: An Emerging Segment of Coastal Tourism

and financial services sectors. Moreover, the resources needed for financing deep-sea mining projects may be large which can help prosper investment banking. Likewise, other sectors of marine services will also deepen in the future.

6. Accounting Framework for Blue Economy

Any serious policy making for blue economy is possible only when the contribution of that sector to national income is known *a priori*. It requires systematic and replicable methodology for recording of data and measurement of activities in the blue economy sectors. Till date, there is hardly any well-defined measure of the size of blue economy. Moreover, without proper accounting of activities it is difficult to formulate and implement blue economy strategies in national development plans. Further, it would complicate cross-country comparisons of the performance of blue economy sectors in different parts of the world.[18] Although some anecdotal estimates of the size of blue economy are available for a few countries including the United States, China, Indonesia and others, there is no clarity over the techniques employed for those computations.

The difficulty in measurement of blue economy is because of ambiguities over the definitional issues. The coverage of sectors and sub-sectors of blue economy cannot be properly articulated as per the existing international economic classifications such as ISIC, CPC, HS, SITC and others. These classifications fail to categorise the land- and ocean-based activities. Even the System of National Accounts (NAS), the most comprehensive accounting framework for measurement of gross domestic product, does not provide any clear picture of the coverage of blue economy activities. In the current version, identification of codes for production and trade in the blue economy sectors is seemingly incomplete and cumbersome. In absence of clear distinction between the ocean economy and blue economy, record and analysis of data for policy making following any of the existing classifications would be misleading and grossly underestimate the potential of blue economy in a country.

Blue economy typically involves numerous types of coastal activities ranging from fishing to tourism. However, there is no such system of reporting of those activities. As a result, any reference to the magnitude of coastal activities in a country or a region is not flawless. Given the difficulty of tracing coastal activities, there has to be suitable coding and tracking system for the coastal activities. For example, the United States uses postal ZIP codes for tracking coastal activities in the country. Innovations of that sort would be necessary for systematic record of activities/services in blue economy sectors. Emerging activities in agriculture, biodiversity and biotechnology areas are not included in ISIC classifications. Besides manufacturing, services such as research and development (R&D) in marine

[18] EIU (2015a).

biotechnology, marine ICT and others are not clearly defined in the existing classification systems. In addition, the role of government particularly with respect to naval and other defence services is not property identified in those statistical systems. The present classification system does not cover high-valued minerals including thorium, hydrocarbons, etc. These sectors are quite substantial as those involve heavy investments in explorations at deep-sea, regular investment in R&D and technology upgradation and services relating to mining, technology development and other services.

Keeping in mind the above mentioned complications in defining and measuring blue economy, the proposed accounting framework should be viewed from the perspective of its coverage, utility and transparency in objective identification of production, trade and services relating to different segments of blue economy. In addition to output, this framework should cover other important macroeconomic data such as value added, employment, capital formation, foreign investment flows, etc. As the concept of blue economy is evolving, the process of developing a robust and credible accounting framework would be in the interests of all the coastal countries embracing maritime economy.

Given the inherent difficulties in classifying blue economy activities, NAS is not appropriate for analysis of blue economy. Although data from NAS would be a great source of understanding of the pattern of blue economy in country, it cannot be relied upon entirely for any meaningful policy making exercises. As tried in a few countries, field surveys on activities in blue economy sectors could provide some lead in formulating methodologies for data collection, compilation and development of suitable statistical framework for measurement of blue economy at national and global levels. As mentioned above, tracking coastal activities by using postal codes (e.g. US & Indonesia) may also be attempted.

7. Blue Economy: Taxonomy of Sectors

Blue economy constitutes a number of economic sectors that are directly or indirectly linked to oceans and ocean-related activities. In the literature those are broadly classified as traditional and emerging sectors without any strict distinction between the two (see Table 1). The importance and relevance of different sectors of blue economy are discussed below.

7.1 Fisheries and Aquaculture

Fishery is a vital oceanic resource that forms the core of blue economy. Besides wild catch, there has been phenomenal growth in fish farming worldwide. While dependence on aquaculture is growing over time due to increasing demand for fish and fish products, people in many parts of the world view aquaculture as a sector for gainful employment and self-enterprise. All the member countries of IORA are well-endowed with fisheries and aquatic plants which could be harnessed for the growth of blue economy. Following the principles of blue economy, the problems of overfishing, IUU fishing, fishing in high and open seas, etc are expected to be regulated even though the focus would still be on the optimum use of fishery stock in the