



# Unleashing the Potential of Blue Economy

## BLUE ECONOMY FORUM

### Introduction

Following decades of debate on the quest for an ideal development strategy which can embrace the Post War concepts of 'growth oriented strategy' and 'sustainable development' in a comprehensive strategy, there is some further development in the form of Blue Economy. Amalgamating positive elements of both the strategies, the Blue Economy has emerged as an alternative development strategy which is consistent with the development thinking of both developed and developing countries. In the Post War period, the growth oriented strategy emphasised on the use of domestic endowments to maintain high growth with stability. With depletion of land resources, development focus gradually shifted towards 'sustainable development' which remains the main plank of development focus. Despite experimenting with both strategies over half a century, underdevelopment remains wide spread in the world over. Now there is a need for a development strategy which can promise high growth with sustainable use of resources for economic development. Blue Economy has the mandate of fulfilling these objectives by relying on the ocean health and resources generated from it. The ocean can unleash colossal opportunities, but sustainability norms need to be adhered to access these possibilities.

### Definition and Measurement

Ambiguities concerning the scope and coverage of blue economy and the overlapping boundaries between blue economy and related concepts such as coastal economy, ocean economy and marine economy complicate the empirical study of blue economy. A proper definition would enable empirical estimation of blue economy for different countries and facilitate cross-country comparison. It would require convergence in competing thoughts and perspectives on the essential features of blue economy. Mohanty, Dash, Gupta and Gaur (2015) define blue economy more systematically by drawing the sharp distinction between the apparently similar concepts such as ocean economy, coastal economy and marine economy. To them, 'Blue Economy' covers all ocean-related activities including direct and indirect supporting activities required for functioning of those economic sectors while adjusting to the costs of environmental damage and ecological imbalance caused due to exploitation of ocean resources for consumption. Blue economy is different from green economy as it goes beyond preservation and addresses sustainability issues with emphasis on regeneration and the evolutionary path of ecosystems.<sup>1</sup> In a larger sense, it means that the world cannot afford to cherish



‘brown economy’ any more as the current practice of production and consumption in the form of massive scale of resource extraction and high carbon energy consumption is not sustainable and equitable. With regard to sustainability, blue economy links production and consumption systems to the long-term capacity of ocean ecosystems and envisages efficiency and optimization of marine resources to ecological limits (EIU, 2015; UNCTAD, 2014). In terms of the broad principles the core elements that represent the distinct features of blue economy are local sourcing of raw materials, employment of local workforce, use of low-carbon energy sources, waste recycling, diversification of food and livelihood options, conservation of living and non-living marine resources, promotion of small-scale industries and so on.<sup>2</sup>

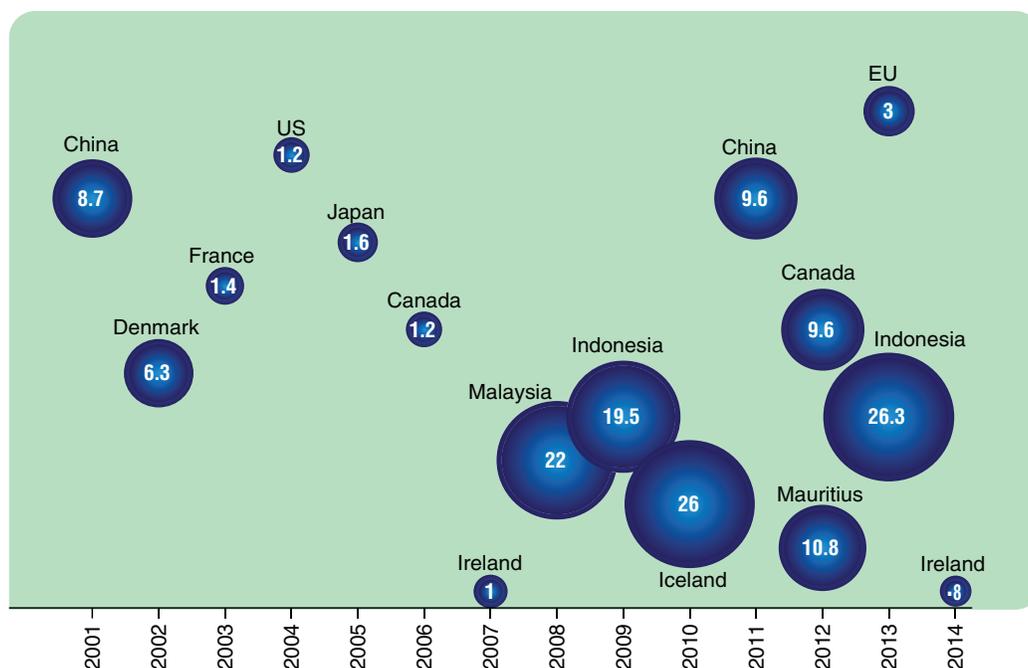
Another crucial issue concerning blue economy is the measurement of its size and the contribution to GDP. Since there is no commonly accepted statistical framework to define the coverage of sectors and the activities in those sectors, the empirical measurement of blue economy remains a contentious area. This is probably the reason for not having any consolidated global database on blue economy sectors. As a result, policy formulation for promoting blue economy and exploring cooperation at the regional levels becomes difficult. The available estimates based on national

statistical systems for the United States, Australia, Ireland, United Kingdom, China, Indonesia and others are merely indicative only and lack consistency and scientific basis for cross-country comparison. Besides certain identifiable major sectors, the existing international and national statistical systems do not provide any systematic basis for valuation and measurement of non-market goods & services and ecosystem benefits, more specifically at higher levels of product disaggregation. Two statistical frameworks such as the National Accounting System (NAS) and Input-Output (IO) table are widely referred in the estimation of blue economy analysis. China uses input-output analysis<sup>3</sup> whereas the United States and EU use NAICS<sup>4</sup> and NACE classifications respectively.<sup>5</sup> Ireland reports statistics on blue economy as per the NACE classification. Regardless of the sectoral coverage, those classifications broadly correspond to the ISIC classifications. As it appears, the accounting system and data reporting will gradually converge to the ISIC categories.

### Contribution of Blue Economy to GDP

There are no comprehensive stylized facts on blue economy except a few spotty evidences for a few sectors in certain countries. Different sectors dominate the structure of blue economy in different countries. For instance, the contribution of agricultural sector to

**Figure 1: Contribution of Blue Economy: Country Experiences**



Source: Authors' compilation from different sources.

Note: The size of the bubble represents the percentage contribution of blue economy to country's GDP.

GDP is 36 per cent for Brunei. Likewise, hydrocarbon accounts for one-third of GDP in the EU. Marine manufacturing and marine services contribute 34 per cent and 83 per cent of GDP in China and the United States respectively. Figure 1 presents variations in country experiences in regard to contribution of the Blue Economy to the overall GDP of littoral countries. In large economies like the US, the EU and China, contribution of Blue Economy to total GDP differs significantly. Taking lessons from small littoral countries like Mauritius, Iceland and Denmark, contribution of Blue Economy has been very large to total GDP. Some large economies like Indonesia and Canada have witnessed impressive rise in the share of Blue Economy in country's GDP. Littoral countries of similar size may not have similar level of contribution by Blue Economy (i.e., Japan and China; Ireland and Iceland). Apparently, the contribution of blue economy to overall GDP of China, and Mauritius is quite substantial; more than 10 per cent. Some countries observe their Blue Economy contributing between 20 to 25 percent of their GDP and some of these countries include Malaysia, Indonesia and Iceland.

In the existing literature, estimates are available for a few countries. For each country, estimates are also calculated for one or a few points of time, barring some countries like the US and Australia. This indicates complex nature of estimation procedure

involved in the valuation of the Blue Economy. As mentioned above, these estimates are merely indicative in nature. Policy inputs cannot be inferred out of these sporadic computations. It requires time series data on various activities in different sectors of blue economy. Employment creation in blue economy sectors appears to be impressive. The magnitude of job creation in China, United States, UK, Canada and France highlights the importance of blue economy for achieving sustainable and inclusive growth in the coastal nations. Although the size of blue economy is significantly large for some countries, there are some blue economy-driven economies such as Seychelles and Mauritius whose future depends on the performance of the blue economy itself.

### Opportunities in Blue Economy Sectors

Blue economy sectors are believed to have huge untapped potential which could go a long way in diversifying the local economies in the coastal nations by generating additional output accruing from utilization of marine resources and expanded occupational choices created with local knowledge and resources. Besides diversification of individual sectors, an integrated and holistic approach towards blue economy can help multiply inter-sectoral linkages as well.<sup>6</sup> Table 1 presents the sectors and industries that are covered under the purview of blue economy.

**Table 1: Taxonomy of Blue Economy Sectors**

Broad NAS Sector	Sub-Sector	Industries	
		Traditional	Emerging
Agriculture	Fisheries	Capture fishery, Seafood processing	Multi-specie aquaculture; fish processing; marine aquatic products
Manufacturing	Deep-sea mining	Oil & gas exploration,	
	Marine biotechnology		Marine derived bio-products, seaweed harvesting, seaweed products
	Boat & ship making		
	Ship repairing		
Services	Ports & Shipping		
	Tourism	Coastal tourism, Eco-tourism and yatching	Cruise tourism, nautical tourism
	Transportation & logistics		
	Marine construction	Short sea shipping	
	Maine commerce		
	Marine ICT		High-tech marine products and services
	Banking & financial services		Marine legal services, Marine financial services, marine insurance, marine
	Marine renewable energy	Offshore wind, offshore wave, tidal	

Source: Mohanty, Dash, Gupta and Gaur (2015) based on various sources.

## Fisheries and Aquaculture

Fishery accounts for a significant fraction of blue economy output in many coastal nations of the world. With advancement in fishing technology, the dependence on fishery for food and livelihood<sup>7</sup> is growing rapidly. Trade in fish products has also increased.<sup>8</sup> Rising consumption combined with stagnant capture production sends worrying signals in view of the faster depletion of biological stock of major fish species. Fish farming meets the growing demand for raw and processed fish products, however at the cost of environmental pollution. Moreover, aquaculture is unlikely to be substituted for capture fishery as natural endowment of fish species and aquatic plants is not only a source of subsistence and commercial fishing but contributes to the health of ocean habitat also. Better processing facilities, harmonization of food safety standards and effective legal and governance mechanisms would enable value addition and make fish trade more remunerative. India, China, Indonesia, Thailand, Bangladesh and Japan are the leading nations of the world for fish production and trade. Pelagic fishes are mostly demanded in the USA, EU and Japan. For food and livelihood security, processed fish industry would play a big role. Aquaculture would continue to be the major source of supply for consumption of raw fish and processing. Investment in processing technology and integration to the fish value chain would promote fishing and fishing-related services in the coastal nations.

## Offshore and Deep-Sea Mining

Marine minerals in the coastal areas and in the seabed would play key role in development of blue economy. Offshore minerals particularly placers are sources of important metals like titanium, tin, rutile, ilmenite and monazite. Placer minerals are used for various industrial applications in electronics, aerospace, petroleum, paint, bio-medical and refractory industries. There are plenty of placer deposits along the Indian Ocean rim region. Indian companies are exploring joint collaborative initiatives with foreign companies to utilize the huge reserve of placers in its coasts. On the seabed, three different types of mineral deposits such as seafloor massive sulphides (SMS), polymetallic nodules and cobalt crusts are found. SMS deposits that include copper, zinc, lead, gold, silver, etc are largely found in the Mid-Atlantic Ridge, Indian Ocean Ridges and the South West Pacific. Polymetallic nodules comprising of manganese, nickel, copper, cobalt and

others are found in Clarion-Clipperton Zone, Peru Basin, Penyrlyn Basin and Central Indian Ocean. In addition, the Pacific Prime Crust Zone (PPCZ) and North-East Atlantic are rich in cobalt crusts. On technology front, marine submersible and mining technology is advancing fast in many mining nations of the world. While UK, China and other countries are thinking of up-scaling activities for deep-sea mining, the Pacific Islands including Fiji, Papua New Guinea, the Solomon Islands, Tonga and Vanuatu have granted permits to global mining companies for deep-sea exploration. In terms of regulations, the International Seabed Authority (ISA) is still working on regulations for commercial mining on the seabed even though it has issued licenses to many countries for exploration in deep-sea. Till date, there is no commercial deep-sea mining in the world even though various agencies have estimated its potential. Nautical Minerals of UK will be the first commercial venture to begin commercial operations in the Papua Guinea national waters in the year 2018.

## Marine Manufacturing

Marine manufacturing covers several sectors including marine engineering and instrumentation, deep-sea mining technology, marine biotechnology, ship making and repairing, boat making, and related activities. In the marine biotechnology sector, the USA, EU and some other countries have achieved remarkable progress in development and commercialization of drug molecules, nutraceuticals and functional foods. Despite strong commercial interests in the sector factors like longer gestation period for understanding the structure of compounds, uncertainty over extraction and fermentation of marine organisms, financing of R&D and commercialization of drugs act as disincentives for large-scale investments by the private companies. Small and Medium Enterprises (SMEs) dominate this sector even in European countries that are at more advanced stages of product innovation, networking and marketing.<sup>9</sup> Moreover, most of those companies focus on a few products in one of three segments of blue biotechnology industry- pharmaceuticals, nutraceuticals and functional foods. Many of them switch from drug development to production of food additives, proteins, enzymes, etc on grounds of high risk of returns to investment. As of date, drugs developed from marine organisms are primarily anti-cancer and anti-inflammatory. Marine organisms that are the sources of most marine compounds are microalgae, sponges, fungi and bacteria.<sup>10</sup> Harvesting

of marine organisms has improved with better underwater exploration technology, innovations in scuba diving and introduction of Remotely Operated Underwater Vehicle (ROVs), unmanned vehicles and gliders (Greco and Cinquegrani, 2016). Likewise, significant potential exist in other sectors of marine manufacturing as mentioned above.

### Offshore Ocean Energy

The commercial exploitation of renewable offshore ocean energy sources is expected to bring transformation in the global energy scenario. As per estimates, the world can develop 337 GW of ocean energy and create 300,000 jobs by 2050. Unlike other sources of renewable energy, ocean energy technologies are not yet fully tested for commercialization. For instance, despite a number of pilot and demonstration projects in the wave energy sector, a few cases of commercialization are observed.<sup>11</sup> Among other sources, tidal energy technologies are more mature and commercially viable. The new technologies developed for tidal range power generation are tidal lagoons, tidal reefs, tidal fences and low-head tidal barrages. Likewise, 40 new devices are also introduced in tidal stream technologies during 2006-13.<sup>12</sup> The leading countries for technology development in tidal energy are Canada, China, France, Ireland, Japan, South Korea, Spain, UK and USA. It is believed that offshore solar could be a leading source of renewable energy. However, the Levelised Cost of Energy (LOCE) per kWh is high for offshore energy compared to other ocean energy sources (Kumar, Shrivastava and Untawale, 2015). Financing of offshore wind farms could be a potential hurdle for technology development and installation. By examining the financing pattern of wind farms in EU, EWEA (2013) provides alternative funding models which involve project finance, project bonds, recycling and re-financing of debt and equity investments by the power producers, and so on. In order to develop these sources as sources of household and industrial energy consumption, emphasis should be placed on development of cost-effective ocean energy technologies and sustained flows of investment for commercialization.

### Marine Services

Along with growth in services sectors worldwide, the interest in marine services is also growing particularly in the blue economy-driven economies. Marine services include diverse sub-sectors such as

port & shipping, coastal and eco-tourism, marine ICT, marine banking & insurance, marine commerce and so on. Most of those sub-sectors possess enormous potential for innovation, growth and occupational diversification.

Rise in seaborne trade and commercial shipping along with a host of other factors such as demand for raw materials, rapid industrialisation, trade liberalization, urbanization and competitive international ore prices provide impetus for the growth of port and shipping services. The activities of this sector include transportation of goods and passengers, pilotage, towing, tug assistance, repairs, anchorage berth and berthing services, storage and warehousing, maritime cargo handling services and custom clearance services. During global boom (2003-07) tonnage demand doubled from 3 per cent in 1990s to 6.5 per cent in the 2000s (Mitroussi, 2013). Some IORA countries including India, Indonesia, Malaysia, Iran, UAE, Singapore, Australia, Thailand, South Africa and Oman have registered robust performance in container port traffic. IORA countries exhibit strong growth in trade of shipping services covering sea transport freight, sea transport passenger and other sea transport.

Globally, coastal tourism is viewed as an emerging segment of blue economy.<sup>13</sup> According to European Parliament (2008), coastal areas are preferred most among the tourist destinations. The universe of coastal tourism covers a range of activities including sea angling, bird watching, boating at sea, dolphin watching, scuba diving, swimming in the sea, cruise and others. Cruise travel is a promising activity in the Indian Ocean, Baltic Sea, Mediterranean and other oceans.<sup>14</sup> There are a number of special interest cruising which include wellness at sea, freighter cruises, river cruises, etc. Hotel & restaurants and transport sector expand along with the spurt in tourist arrivals in the coastal cities and eco-tourism spots. By implementing suitable site development, peripheral development plans for urban fringe areas and innovative financing schemes the potential of coastal and marine tourism can be harnessed fully.

Marine information and communication technology (ICT) sector covering satellite monitoring, analysis of big data for biodiversity, pollution, weather pattern, ecosystem evolution, fishing zone advisory services, ocean state forecast, storm surges, cyclones, monsoon variability, tsunami, R&D services including validation of satellite sensors, parameterization of key processes for models and verification of model simulations is an emerging

sector of blue economy. It may expand further depending upon the emphasis given to ocean data recording, analysis and simulations.

Marine commerce is a pivotal segment of blue economy comprising of business services, marine retail services, marine financial services, maritime insurance, ship leasing, support activities, wholesale trade, maritime legal service and other marine services. Maritime insurance businesses have registered growth over time. Ship finance is another potential sector for expansion in the Indian Ocean region. Marine conservation finance is also emerging worldwide as a separate category of marine financial services.

### Global and Regional Initiatives

The growth of blue economy rests upon a scientific approach towards ocean development. Ocean development broadly refers to proper conservation and management of living resources such as fisheries and aquatic plants and non-living resources such as minerals, oil & gas, etc; identification of new resources, enhancing use of existing resources, and international cooperation in governance and regulation of marine resources. Different national and regional initiatives are underway to promote blue economy in the coastal economies. In essence, those initiatives envisage a future roadmap for blue economy setting certain measurable outcomes and the enabling conditions to achieve them. Some countries have passed National Ocean Acts<sup>15</sup> whereas some others have made special budgetary provisions for blue economy. Some of those countries that have National Ocean Policy include Australia, Brazil, Canada, China, Colombia, Japan, Norway, Portugal, Russia, United Kingdom and the USA. Three countries such as the USA, Canada and Australia have special legislations and specific provisions for ocean policy in their national budgets. Moreover, Canada and Australia have established a systematic hierarchy of institutions at federal and state levels to plan, coordinate and monitor the progress on various pillars of ocean policy. In Canada, three different layers of institutions comprising of National Ocean Act, Ocean Strategy and Ocean Action Plan govern the development, management and governance of ocean resources. Similarly, a multi-layer institutional architecture consisting of Ocean Policy, Regional Maritime Plans, Integrated Ocean Planning & Management, Minister for the Environment and Heritage, National Advisory Group and others deal with marine and marine-related issues.<sup>16</sup>

Countries such as Seychelles and Mauritius have established separate ministries for blue economy. Some countries have formulated integrated maritime policies for promoting blue economy sectors and industries in their economies. For example, the Government of Mauritius formulated a Roadmap for Ocean Economy in 2013 which included diverse objectives, action plans and mutual-reinforcing sectoral components. In 2009, the Government of Australia launched a Strategic National Framework for Marine Research and Innovation. In Europe, the Netherlands, Denmark and Norway are quite successful in implementing the blue economy policies. Following their success, Ireland introduced a Marine Knowledge, Research and Innovation Strategy in 2006 for the period 2007-13 which aimed at policy measures to promote blue economy sectors in the Irish economy. The CARIFORUM-EU Economic Partnership Agreement signed in 2008 encourages the importance of fisheries and other living marine resources in the CARICOM member states and the Dominican Republic. Likewise, the Interim Partnership Agreement between the European Community and the Pacific States contains provisions for trade in goods with a special derogation in Rules of Origin for fishery products.

Among the EU members, the region-wide research and networking initiatives such as EU Joint Programming Initiative Healthy and Productive Seas and Oceans (JPI-OCEANS), European Marine Biological Resource Centre (EMBRC), CSA MarineBiotech, European Research Area Network (ERA-NET), Association of European Marine Biological Laboratories (ASSEMBLE) and others are aimed at developing a common research infrastructure and coordinated research area in the field of marine biotechnology. Trans-regional initiatives like Mediterranean Science Commission (CIESM), Sustainable Uses of Baltic Marine Resources (SUBMARINER) and BioMarine are designed to contribute to promotion of research and applications in marine biotechnology sectors. These national and regional initiatives are necessary to build capacity and foster creativity in core industries and sectors of blue economy.

### Conclusion

Blue economy is being viewed as a holistic development paradigm that propagates a growth process which stresses upon the optimum and efficient utilization of marine resources without compromising the sustainability aspects. In essence, blue economy paradigm emphasizes upon

maximum and economically efficient utilization of under-exploited marine resources or new marine resources which are currently not used either for household use or for commercial purposes. This approach towards marine resources fits well to the coastal nations whose economic fortunes depend on the marine resources particularly the Small Island Developing States (SIDSs) such as Seychelles and Mauritius. Even the advanced economies such as the USA, Canada and Australia consider blue economy as the new source of economic growth especially after the economic recession following the Subprime crisis in 2007. By and large, all coastal nations across the income categories now view blue economy as an important sector of their economies which gets reflected in the enactment of specific legislations and programmes for ocean development. Many countries in the Indian Ocean region including India, Australia, Bangladesh, South Africa, Kenya, Mauritius and Seychelles view blue economy as a strategic economic sector for achieving economic growth and other developmental objectives.

While there exists some sort of consensus over the potential of blue economy (at least in terms of broader objectives) for social and economic development, uncertainty prevails over its quantification and empirical validation. At present, there is no such universally acceptable definition of blue economy which not only create difficulty for measurement of its size and related indicators but also affects the policy making process for ocean resource development and management. Based on available literature Mohanty, Dash, Gupta and Gaur (2015) have attempted to clarify those contentious issues to a reasonable extent. Blue economy broadly covers living resources such as fisheries and aquatic plants and non-living resources such as polymetallic nodules, cobalt crust, rare earth metals and other minerals, oil & gas, port & shipping, coastal tourism, marine biotechnology, marine commerce and so on. Of those, capture fishery, oil & gas exploration, shipping, coastal tourism etc. are the traditional sectors whereas multi-specie aquaculture, fish processing, marine-derived bio-products, seaweed products, cruise tourism and high-tech marine products are some of those emerging sectors of blue economy. Besides their current level of contribution, there is immense potential existing in the above mentioned sectors for diversification and industrial applications.

Among a set of policy measures, role of investment in technology & process development and blue economy-specific legislations and policies

are indispensable. The SIDSs such as Mauritius and Seychelles have created separate ministries for blue economy and formulated different policies to promote blue economy in their countries. To a great extent, these two countries are blue economy-driven economies as a significant fraction of their gross domestic products originate from blue economy sectors. Regardless of the level of development, countries including advanced economies such as Canada, USA and Australia and developing economies such as India, South Africa and Kenya recognize the merits of emphasizing upon the marine resources for expanding economic activity and creating jobs especially in a world that confronts the challenge of climate change, resource depletion, killer diseases like Ebola, natural disasters like Tsunami and others. Barring economic considerations, the countries that embrace blue economy as a development paradigm implicitly value the importance of resource sustainability and other parameters of environmental and ecological sustainability. With sustained efforts, blue economy shows great optimism towards achievement of the Sustainable Development Goals.

#### Endnotes

- 1 See Pauli (2015). Our intention here is not to distinguish between 'green economy' and 'blue economy' rather to highlight the unique features of blue economy.
- 2 See UNECA (2015), UNCTAD (2014), EIU (2015a) and EIU (2015b) for sectoral inter-linkages among the blue economy sectors.
- 3 Wang (2016) adopts the input-output table to estimate activities in different ocean industries in China.
- 4 See Colgan and Kildow (2013).
- 5 National Ocean Economics Program (NOEP) of the United States provides data for ocean economy and coastal economy separately as per the NAICS 2004 classification. Park (2014) mentions the difficulties of computing measures of blue economy for Korea due to absence of any national statistical framework for ocean economy.
- 6 Mohanty, Dash, Gupta and Gaur (2015) identify the key sectors of blue economy and the likely intensification of activities in those sectors in the Indian Ocean region.
- 7 FAO (2007) highlights the role of small-scale fishery in poverty alleviation and food security.
- 8 See FAO (2014).
- 9 Information about blue biotechnology sector is scattered. Even the reports on biotechnology by leading consulting firms like Ernst & Young and Deloitte do not mention the names of the companies those deal with marine organism and molecules (Greco and Cinquegrani, 2016).
- 10 Rangel and Falkenberg (2015) mentioned that the no. of bioactive natural products derived from marine organisms has increased due to improvement in techniques for elucidation of chemical structure of the molecules and chemical synthesis in the 1990s.

- <sup>11</sup> See IRENA (2014a).
- <sup>12</sup> For tidal energy policies in different countries, see IRENA (2014b).
- <sup>13</sup> UNEP (2009) observes that growth of coastal tourism has reached its peak in the recent decades.
- <sup>14</sup> Polat (2015) mentions four different types of markets for cruise travel: - (1) contemporary market, (2) premium market, (3) luxury market and (4) adventure/ exploration market.
- <sup>15</sup> Regional mechanisms would help pursue mutual goals among SIDSs (See UNECA, 2015).
- <sup>16</sup> See Repetto (2005).

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