

SCIENCE, TECHNOLOGY AND INNOVATION FOR SUSTAINABLE OCEAN ECONOMY

A South Asian Perspective

Lam-ya Mostaque

Research Officer, Bangladesh Institute of International and Strategic Studies (BISS)
1/46 Old Elephant Road, Ramna, Dhaka 1000, Bangladesh
Tel: 9336287, 9353808; Ext 133
E-mail: lamya.mostaque@gmail.com.

Abstract

Countries all over the world are now becoming more interested in the ocean economy and looking for sustainable ways of exploring and utilizing them. The South Asian countries are looking to use the potential of the ocean available to them. To harness the vast resources of oceans while preserving its environment, the advancement of science, technology and innovation is key. This is particularly true for South Asian countries that are among the worst victims of climate change. However, the countries are not yet that much advanced in terms of ocean technology. The paper tries to gauge the existing state of oceanic research and technology in South Asia and provide some useful recommendations for future steps. In doing so it explores the different avenues of science, technology and ocean. It also looks into the cases of Australia, China and the European Union to see how they are advancing the agenda of oceanic research and development. The paper concludes by providing some ways ahead for the countries of the region.

Introduction

In the 21st century, seas and oceans provide new frontier for mankind to venture in. Oceans have also been labelled as “economic frontier” as the expanding global population looks for new sources of livelihood and prosperity. Development of the ocean economy, which includes more than 80 per cent of global trade, marine and coastal environments is a major resource for the overall economic development of humankind (IORA, 2020).¹ All over the world countries are trying to find ways to efficiently enhance the use of the ocean for trade, commerce and economic activities. While it is important to explore the oceanic resources for economic purposes, it is equally important to keep in mind that

the ocean is home to a vulnerable ecosystem that can be destroyed with reckless endeavours.

The increasing impact of climate change has heightened the need to be more careful about the environmental impact of our economic activity. The commitment to ensuring that development of today does not hamper the ability of the future generations to develop themselves is further enhanced due to the adoption of the sustainable development goals (SDGs) by world leaders at the UN General Assembly in 2015. Goal Number 14 of the SDGs, titled ‘Life Below Water’, encompasses many important aims for the better use of the oceans. Some of the key goals of the SDG 14 include: enhancing conservation and

the sustainable use of ocean-based resources, wise management of resources, and the protection of marine and coastal ecosystems from pollution, including the impacts of ocean acidification (UN, 2015).² All of those goals are incorporated into the concept of the sustainable ocean economy.

Two-thirds of the earth’s surface is covered by Oceans and it is estimated that over three billion people either directly or indirectly depended on marine and coastal systems for their livelihoods (Senaratne, 2017).³ The importance of harnessing ocean economy is, therefore, cannot be stressed enough. But sustainable ocean economy has to be based on clean technologies which will ensure the economic and social needs of the people without damaging the planet. The traditional economic activities often do not take into account environmental factors. Side effects of unchecked economic activities such as overfishing, pollution and ocean acidification are causing significant damages to the ocean and its environment. Thus, it is only through new technologies and innovation that the world can find ways to properly utilize the resources available at the sea, without causing damage to the environment. Science and technology will have to search for new sources of growth, while innovative advances will make new resources and spaces accessible for development.

The South Asian subcontinent is located at the bank of the Indian Ocean, with plenty of the territory for them to explore. It is one of the most populous regions of the world, but at the same time, it is also the fastest-growing sub-region in terms of

¹ Indian Ocean Rim Association (2020), “Blue Economy”, available at <https://www.iora.int/en/priorities-focus-areas/blue-economy>, accessed on January 1, 2020.

² United Nations (2015), “Transforming the World: The 2030 Agenda for Sustainable Development”. A/RES/70/1.

³ Senaratne, A. (2017), “Oceans and Sri Lanka’s future: Towards a blue economy”, *The Daily FT*, available at <http://www.ft.lk/article/620407/Oceans-and-Sri-Lanka-s-future--Towards-a-blue-economy>, accessed on December 27, 2019/

economy. Since, 2014, with an average growth rate of 7% (Song, 2019).⁴ With the exploration of their maritime territories, the countries are standing on the verge of opening new avenues for their economies that can take their countries to the next stage of development, ensuring the rights of their people and community. There is a significant interest among the nations to deal with sustainable ocean economy/blue economy and the term is often used in government policy papers. However, the vast oceanic resources of the Indian ocean and the Bay of Bengal can only be explored if the countries find technological methods to do so, which remains a significant challenge for the countries of the region.

It is in this backdrop, this paper tries to understand what initiatives the South Asian countries need to initiate in order to achieve a sustainable ocean economy, particularly to boost innovation in ocean technology. The paper begins by linking science and technology with the ocean economy to see what kind of technologies is needed for sustainable ocean economy. The next section looks into the existing initiatives for ocean economy and technological advancement taken by countries and regional organizations in South Asia. The following section looks into the initiatives taken by other countries/institutions around the world to find out the best practices in oceanic research and innovation, here the paper takes Australia, China and the European Union as case studies. The following section provides recommendations as to how to initiate advancement in the field of science and technology. The last chapter concludes the paper.

Sustainable ocean economy: What technologies we need?

The ocean is often termed as mankind's final frontier in the earth that is still largely unexplored. Exploring the huge grounds of oceans and seas will require mankind to

find a new science, technology and innovation that will help them to harness the vast resources of the ocean economy. Additionally, new technology is also required to make the existing economic activities in the ocean more cost-effective and environmentally friendly. The challenges of the ocean economy are to use the resources available at the ocean while maintaining environmental sustainability. In this area too, science and technology will help mankind to find ways to do that successfully. In this regard, The Organisation for Economic Co-operation and Development (OECD), in its website links a number of ways that the science, technology is required and will be useful for a sustainable ocean economy.

The first requirement for successfully exploring the oceans is to know about it more thoroughly, for which there is need for data about the oceans. This calls for more ocean observation and scientific missions. Ocean observations and scientific missions can provide new evidence and data which increases the understanding of the ocean. The countries need to invest more in equipment that will acquire and generate data about oceans. The data collected from those pieces of equipment can be used for research by scientific communities as well as by other public and commercial parties. Scientific exploration is needed for doing the stock take of existing oceanic resources and find out previously unknown resources. More scientific research will strengthen the countries capacity to use its ocean resources in a safe, effective and sustainable way. This will protect the ocean environment and can even find out more commercial uses of the ocean. Furthermore, in recent times the oceanic observations are also being used to monitor the development of ocean economic activities and to improve marine spatial planning.

Another major use of science and technology in regards to the ocean economy is

using them to stimulate improvements in efficiency, productivity and cost structures in the ongoing oceanic activities. Whether it is shipping, port facilities, energy or tourism, scientific research is required to make them more cost-effective. Technologies such as imaging and physical sensors, satellite technologies, advanced information and communication technology (ICT), big data analytics, biotechnology, nanotechnology and subsea engineering etc. For example, many OECD countries are starting to use Blockchain and big data analytics applications in their port facilities and maritime supply chains. This will help them to provide more integrated services for shipping companies, port operators and marine transport stakeholders while saving cost by deploying a more efficient system, all while improving the overall quality of service (OECD, 2019).⁴

Perhaps the most popular area where technology is used in the ocean economy is the marine or blue biotechnology. It is deemed so important that the Indian Ocean Rim Association (IORA) included marine biotechnology research and Development as one of the six priority areas. Marine biotechnology has an important role in the extraction of marine species, which are then applied to a number of sectors including biotechnologies, nanotechnology, biomaterials and the introduction of genetically modified fish, which can yield high economic returns (Ninawe and Indulkar, 2019).⁵ The ocean environment is still a largely unexplored area where new compounds can be found with potential to be used in novel drugs, health, nutraceuticals and personal care products. Further, the blue biotechnology can help in environmental issues. For example, bioremediation can be used for breaking down ocean pollutants and it can also help in developing cost-effective and non-toxic antifouling technologies (IORA, 2020).⁶

⁴ Song, L. L. (2019), "How South Asia can continue as world's fastest growing subregion", available at adb.org/news/op-ed/how-south-asia-can-continue-world-s-fastest-growing-subregion-lei-lei-song, accessed on 3 January, 2020.

⁵ OECD (2019), "Innovation for a sustainable ocean economy", available at <http://www.oecd.org/innovation/inno/ocean-economy/>, accessed on January 2, 2020.

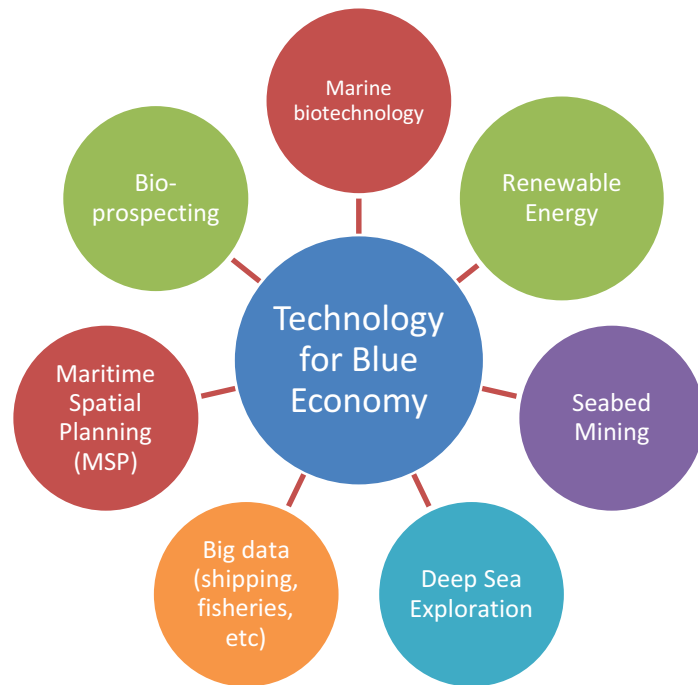
⁶ Ninawe, A. and Indulkar, S.T.(2019), "Blue Economy Mission: India's Focus", *Journal of Aquaculture & Fisheries*, Vol. 3, No.017.

There is also the renewable energy sector where new technology and innovation is largely required. As the world tries to combat the adverse impacts of climate change, technologies for renewable energy from the ocean will become increasingly important. At present, renewable energy technologies are in various stages of commercialization in the ocean economy. The type of energy that is being used includes the widely established offshore wind industry, the harnessing of the wave, current, and tidal energy, and the capture of ocean thermal and salinity gradient energy (Patil et al., 2018).⁷ The amount of tidal and wave energy that is being generated is still quite low. The biggest wave energy farm which is under construction in Lewis coast in the North-western Scottish province will generate 40 Megawatt upon completion.⁸ However, with its environmentally friendly features and vast oceanic resource, the wave and tidal energy can be the future for energy of this planet.

Figure 1 shows some of the areas where technology is extremely important for the exploration of sustainable ocean economy.

Ocean and technology: Current situation in South Asia

The countries of the South Asian sub-region have a huge potential in the ocean economy. There has been plenty of talk regarding ocean economy/ blue economy in the policy spaces; however, there are still not many concrete policy initiatives in the countries regarding the ocean economy. One area that the countries are particularly lagging behind is the science, technology and innovation. The sub-region is not particularly advanced in science and innovation, with only India holding a distinctive Global Innovation Index ranking in 2019 (ranked 52).⁹ The lack of specific



Source: compiled by the author

Figure 1: Areas where technology extremely important for the exploration of sustainable ocean economy

blue economy strategy in the countries has also contributed to lack of scientific research and innovation in regards to the ocean economy.

India

For India, ocean economy initiatives have mostly consisted with port facilities and building partnership with many of its neighbours. So far, the country has blue economy cooperation initiatives with Seychelles, Mauritius, Sri Lanka and Bangladesh among other countries and ocean technology is one of the areas of cooperation among others (Islam and Mostaque, 2019).¹⁰ When it comes to ocean technologies, the country has generated significant revenue for marine biology and biotechnology. It has been projected that the country

will generate USD 100 Million by 2025 through biological and bio-technology industrial growth. The Indian Department of Biotechnology has taken initiative to explore the potentials. The department is setting up an institute on ocean biology and bio-technology for research and development of oceanic resources. On the other hand, the Indian Ministry of Shipping is also becoming more tech-savvy. It has started using IT enabled services extensively for its port-led development programmes (Ninawe, and Indulkar, 2019).¹¹ Additionally, under the “sagar-mala” initiative, it is assisting in increasing Africa’s maritime capabilities, which includes development of maritime capacity building in, among other areas: coastal area development, port infrastructure buildings,

⁷ Indian Ocean Rim Association. (2020), “Blue Economy”, *op. cit.*

⁸ Patil, P.G.; Virdin, J.; Colgan, C. S; Hussain, M.G.; Failler, P. and Vegh, T. (2018). *Toward a Blue Economy: A Pathway for Sustainable Growth in Bangladesh*. Washington, DC: The World Bank Group.

⁹ Marine Insight (2019), “The World’s Largest Wave Farm”, available at <https://www.marineinsight.com/offshore/the-worlds-largest-wave-farm/>, accessed on January 23, 2020.

¹⁰ WIPO (2019), “Global Innovation Index 2019: India Makes Major Gains as Switzerland, Sweden, U.S., Netherlands, U.K. Top Ranking; Trade Protectionism Poses Risks for Future Innovation”, available at https://www.wipo.int/pressroom/en/articles/2019/article_0008.html.

¹¹ Ninawe, A. and Indulkar, S.T.(2019), *op. cit.*

marine sciences, renewable energy and hydrography.¹²

Bangladesh

Bangladesh, on the other hand, has also been very enthusiastic regarding the exploring its ocean, especially after the demarcation of its maritime boundary in the area of the Bay of Bengal. Bangladesh's Seventh Five Year Plan, the national plan for Bangladesh's economy has mentioned the blue economy in it. The plan calls for twelve actions to be undertaken for maintaining a prosperous and sustainable Blue Economy.¹³ In 2017, the Government of Bangladesh established the "Blue Economy Cell" with the mandate to coordinate Blue Economy initiatives across sectoral ministries (Islam and Mostaque, 2019).¹⁴ Additionally, the Blue Economy sector of the country's Ministry of Foreign Affairs has identified 26 potential Blue Economy sectors (MoFA, 2018).¹⁵ Among these 26 sectors, marine biotechnology is identified as one of the key sectors. It also identifies the lack of sound technology and technical-technological capacity as one of the main challenges for the development of sustainable ocean economy in Bangladesh. However, the country has established Bangabandhu Sheikh Mujibur Rahman Maritime University and an Oceanographic Research Institute in order to promote education and research about the ocean and maritime resources.

Sri Lanka

Sri Lanka, another of the countries with vast access to ocean has also been venturing in the ocean economy development. The Government of Sri Lanka has promoted a Blue Economy initiative under the 'Sri Lanka NEXT' program in October 2016 (Senaratne, 2017).¹⁶ The country is an important link for sea lanes through its ports and has tremendous tourism

prospects as well. The Government of Sri Lanka, through the "Report on Sustainable Sri Lanka 2030 Vision and Strategic Path" published in January 2019, has once more emphasised the importance of development in oceans that will decouple socio-economic development from environmental and ecosystem degradation. The report highlights several areas of sustainable ocean economy including new technologies, business models and innovations for promoting or restoring ocean health and states that the ocean is "a huge laboratory" and source for blue biotechnology. Additionally, the report acknowledges the lack of marine knowledge and research capacity and recommends building a national institution for ocean exploration and innovations. That institute will collaborate with other similar national and regional institutes. The plan also includes a recommendation for establishing a supra-ministerial task force supported by a lean management team to implement a focused "Experiment Nation" initiative. It should also be mentioned that considerable progress has been made in the development a Marine Environmental Baseline Information Network (MEBIN), which has been initiated by the Petroleum Resources Development Secretariat of the Sri Lankan Government (PEC, 2019).¹⁷

Regional Organizations

As for the regional organizations, SAARC and BIMSTEC have started venturing area of the ocean economy. The 18th SAARC Summit Declaration recognized the vast prospects of the blue economy in the South Asia region (Rahman, 2017).¹⁸ Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) also has been looking into the blue economy sector; its interest

in the area was discussed during the 4th Summit of BIMSTEC.¹⁹ However, there has not been any significant progress in regards to this area, especially cooperation in science and technology. The countries and regional organisations, in general, are not very advanced in regards to the ocean technology initiatives. However, the countries are identifying this gap and are starting to take action in this area, which is a welcome initiative.

Case Studies: Australia, China and the European Union

As mentioned before, exploring the ocean economy is one of the most trending policy discussions of this century. Many countries have already taken the initiative to explore and harness their oceanic resources. However, the priority for the countries in the ocean economy is not the same for every country. Some countries are prioritising economic benefits, while others are more focused on conserving the environment (Islam and Mostaque, 2019). Only a handful of countries are employing innovative methods to balance between both. Here, the paper has included the case study of Australia and China, both of the countries are investing in the science and technology aspect of the ocean economy. In addition, the paper also examines the efforts made by the European Union (EU), because they have also made significant efforts in developing science and technology in the ocean economy for the perspective of a regional organisation.

Australia

The Australian Government has chosen to term sustainable ocean economy as blue economy and it defines it as "a Blue Economy is one in which our ocean ecosystems bring economic and social

¹² Attri, V. N., (2016), "An Emerging New Development Paradigm of the Blue Economy in IORA: A Policy Framework for the Future", University of Mauritius, available at <https://www.iora.int/media/23838/the-blue-economy-and-iora-2016.pdf>, accessed on 26 February 2020.

¹³ General Economics Division, (2015), *Seventh Five Year Plan (FY2016 – 2020): Accelerating Growth, Empowering Citizens*, Dhaka, Bangladesh: Planning Commission, Government of the People's Republic of Bangladesh.

¹⁴ Islam, M. and Mostaque, L. (2018), "Blue Economy and Bangladesh: Lessons and Policy Implications", *BISS Journal*, Vol. 39, No. 2, pp.135-162.

¹⁵ Ministry of Foreign Affairs (MoFA), Bangladesh, Official Website (2018), "Blue Economy National Co-ordination Workshop", available at https://mofa.gov.bd/site/press_release/bb5cd232-1529-46db-aa8c-d0c8bc4c0e47, accessed on 10 January 2020.

¹⁶ Senaratne, A. (2017), *op. cit.*

¹⁷ Presidential Expert Committee, (2019), "Sustainable Sri Lanka 2030 Vision and Strategic Path", Presidential Secretariat: Columbo, Sri Lanka.

¹⁸ Rahman, M. R. (2017). "Blue Economy and Maritime Cooperation in the Bay of Bengal: Role of Bangladesh", *Procedia Engineering*, 194, pp. 356 – 361.

¹⁹ "BIMSTEC focuses on blue economy", *The Independent*, September 1, 2018.

benefits that are efficient, equitable and sustainable” (CSIRO, 2015).²⁰ The actions of the Government of Australia regarding the development of the ocean economy have been mostly concerned with promoting scientific, technological and other innovations. Additionally, they have been proactive in establishing regional cooperation among the neighbouring countries regarding ocean economy and environment. The Australian government has published its ‘National Framework for Marine Research and Innovation’ in 2013. In the plan, it has highlighted the critical areas of marine science that offer opportunities for experimentation and investments. The Framework also included many schemes for improving the quality of marine science research in Australia, including creations of marine infrastructure in terms of observing technologies, observe vessels, etc; reorganization of existing institutions for marine research for better coordination and effective execution (OPSAG, 2015).²¹ Additionally, the Government of Australia has also declared a ‘National Marine Science Plan 2015-2025’. This Plan has been made by drawing together the knowledge and experience of more than 24 marine research organisations, universities and government departments and more than 500 scientists. The plan outlines the science, technology and innovation needed for growing Australia’s sustainable ocean economy and identifies a number of areas for future investments which include (1) National Blue Economy Innovation Fund, (2) National Marine Research Infrastructure, (3) National Marine Baselines and Monitoring Program, (4) National Integrated Marine Experimental Facility, (5) National Ocean Modelling Program, and

(6) Marine Science Capability Development Fund.²² Additionally, the Australian Government also has the Australian Ocean Data Network (AODN), which an interoperable online network of marine and climate data resources for Australia.²³

China

China has been initiating a number of initiatives to forward its scientific innovation for the marine industry and ocean economy. Most of the initiatives by China is aimed at forwarding the economic agenda of the country. However, those efforts are quite advanced compared to many of the other countries. For example, China has established six national marine economic innovation and development demonstration areas and seven national industrial demonstration bases for rejuvenating marine industry with science and technology. These include Shandong Peninsula Blue Economic Zone, Blue Silicon Valley and the strategic cooperation among marine parks and bases in the Yangtze River Delta region. The Shandong Peninsula Blue Economic Zone was established back in 2011 and by 2020, it is planned that the Shandong Peninsula Blue Economic Zone will develop into a blue economic zone that features optimized industrial structure for an ocean economy that promotes harmonious co-existence between human and nature. The Blue Silicon Valley in Qingdao endeavours to establish world-leading centres for marine scientific and technological research and developments and become an innovation platform that enables China to scientifically develop and utilize marine resources and links global marine scientific research resources (Wenhai, 2019).²⁴

European Union

The European Union has been very active in Blue Economy. The first effort in Blue Economy by the European Commission was in 2012 when they formulated “Blue Growth Strategy”. The strategy was aimed at harnessing the possibilities of Europe’s oceans, seas and coasts for growth and job. It identified five focus areas for blue growth, i.e., blue energy, aquaculture, maritime, coastal and cruise tourism, marine mineral resources and blue biotechnology.²⁵ In 2014, EU launched its Blue Economy Innovation Plan, highlighting three aspects: (I) sustainable jobs and growth, (II) knowledge, legal certainty and security in the blue economy, and (III) Sea basin strategies to ensure to foster cooperation between countries.²⁶ Research and innovation in the ocean economy has been a key focus of the EU. During the 2014-2016 period, a total of US\$ 911.68 million allocated to marine and maritime research and innovation projects. In order to highlight the results of its research and innovation in Blue Economy, EU published another report in 2017. The report demonstrated how the EU funded research and innovation projects were helping in meeting the main challenges in sustainable Blue Economy development. The report also talked about Coastal and Marine Spatial Planning (CMSP).²⁷ The organisation has also done studies on specific seas to explore its Blue Economy potential. One of those studies was the western Mediterranean. The European Union has also been very active in protecting the environment. It has put in place the EU Marine Strategy Framework Directive (MSFD) to protect the marine ecosystem and biodiversity.²⁸ Moreover, the EU has also been focusing

²⁰ Commonwealth Scientific and Industrial Research Organisation (2015), *Innovation for the Blue Economy: Workshop Summary*, Canberra: CSIRO, p. iii.

²¹ Oceans Policy Science Advisory Group (2013), “Marine Nation 2025: Marine Science to Support Australia’s Blue Economy”, Canberra: Government of Australia,

²² National Marine Science Committee, *National Marine Science Plan 2015-2025: Driving the Development of Australia’s Blue Economy*, Canberra: Government of Australia, 2015.

²³ “The National Marine Science Plan: The Plan, Challenges & Recommendations”, available at <http://www.marinescience.net.au/national-marine-science-plan/implementing-the-plan/>, accessed on 20 December 2019.

²⁴ Wenhai, L, et al. (2019), “Successful Blue Economy Examples with an Emphasis on International Perspectives”, *Frontiers in Marine Science*.

²⁵ European Commission (2012). *Blue Growth: Opportunities for Marine and Maritime Sustainable Growth*, Brussels: European Commission,

²⁶ Wenhai, L, et al. (2019), op.cit.

²⁷ European Commission (2017), *Report on the Blue Growth Strategy: Towards a More Sustainable Growth and Jobs in the Blue Economy*, Brussels: European Commission.

²⁸ European Commission, “Environment”, 18 May 2017, available at http://ec.europa.eu/environment/marine/eu-coast-and-marine-policy/marine-strategy-framework-directive/index_en.htm, accessed on 15 October 2018.

on sustainable marine energy and blue biotechnology; both of which require a high level of technological innovation (European Commission, 2017).²⁹ Most recently in 2018, it has funded an expert study on sustainable Blue Economy that will suggest pathways for the development of Blue Economy in Europe while conserving of marine and coastal ecosystem (Pantzar and Kettunen, 2018).³⁰

Scope for advancement

The countries of South Asia also have to involve themselves in the area of the sustainable ocean economy in order to not fall behind from the rest of the world. It is evident that the countries have considerable desire to engage in the oceanic economy; however there is still a lack of coordinated action on their behalf for the advancement of this area. As science, technology and innovation hold great importance in the investment of sustainable ocean economy; the countries need to invest in this area for future needs. The countries of the region can, therefore, take the following actions.

Countries need to invest more in the scientific exploration of the sea; these explorations will provide the countries data regarding their available resources in the ocean. They should also invest in the satellite and imaging systems, which will help them in improving their sea routes and port facilities among other things. The ports should use big data analysis to improve their service delivery and efficiency. This has the potential to have an impact not only the ocean economy but the economy of the country as a whole, as improved port facility will boost trade and commerce.

More investment should be made in the area of biotechnology, in order to find new resources for pharmacy, beauty industry and other products. Investment is also required to improve technology in fishing and marine aquaculture. The World Bank

is already investing in a fisheries and aquaculture fund called "PROFISH", which is a multi-donor trust fund housed at the Bank. To date, PROFISH has investments of US\$ 4.5 million in research, analysis and technical support.³¹ Countries can seek assistance from that fund in order to develop their own technologies.

Countries can also follow the example of China and develop dedicated marine economic innovation and development demonstration areas. In addition, they can also establish marine silicon valley, Blue Economic Zone and marine industrial parks. These initiatives are likely to boost the research and development in the ocean economy and boost their economies.

Countries also need to increase cooperation between them for improving research in the ocean economy. More agreements need to be taken place between countries for bilateral cooperation between them for research on areas of mutual interest. For example, Bangladesh and India can cooperate on maritime aquaculture, in particular to the species Hilsa, which is of the great demand from both countries consumers.

As for the regional organizations, IORA, SAARC and BIMSTEC can all invest more attention to the scientific research on sustainable ocean economy, particularly on technological advancement and innovation. Specially IORA, which already focuses on the blue economy, can follow EU's example and develop a plan for science, technology and innovation which will dictate goals for countries in regards to ocean research. In addition, regional organisations can also have specific funds for scientific research on ocean economy.

The vast resources required for research in the ocean also calls for private-public partnership (PPP) in this area. Since scientific oceanic research helps both government and private companies looking to venture in the ocean economy, this can be a good

place for PPP. Not only in investments, but cooperation can also be in terms of data collection, where sharing each other's inventory will bring greater benefit for all.

Lastly, the SMEs are some of the key agents who will bring the benefits of the ocean economy to the people and the local community, then they also need to be involved in the process. The government can think about providing funds for SMEs who are involved in sustainable ocean practices. Further, "Marine innovation award" may be introduced for SMEs who bring sustainable and innovative ideas in acquiring marine resources.

Conclusion

The ocean provides great opportunities for economic endeavours and can open a great window for the development of humankind. But at the same time, any exploration of the ocean has to be done in a manner that does not harm the fragile ecosystem and environment of the ocean. Otherwise, the results can be catastrophic and can further intensify the impacts of climate change. Here new technology and innovation can help to find out ways for sustainable ocean economic activities. It can also help in modifying the existing economic endeavours to become more efficient and environmentally friendly. The South Asian sub-region is still lagging far behind in scientific research and development in regards to the ocean economy. However, learning from the experience of the more advanced nations in this area and by extending the hand of cooperation with each other, they can venture further in the area of science, technology and innovation in the sustainable ocean economy.

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