Chapter 13

Moving to a Smart Blue Economy

Introduction

The Blue Economy is a much talked about space that spans all activities in the ocean intended at industrialising it on a sustainable manner. This mode of industrialisation that ought to be sustainable, becomes thus a point of contention when indicating that sustainability principles on land should be applied on the oceans as well. The Blue Economy is seen as the ocean space where maritime and marine matter converge (Smith-Godfrey 2016) meaning that maritime is all the man-made structures on the sea and marine is all the God-made structures. The naval component is interesting as it includes the safety and security aspect of the oceans. The oceans are undergoing a massive transformation as it is in the thrust of the Fourth Industrial Revolution. The impacts of the Fourth Industrial Revolution on the Blue Economy are located in the different key technologies that became available in its different application areas. This comes at a time where the middle class of developing countries in Africa are increasing, having an impact on the consumption of raw materials, food and energy production.

This presents the biggest opportunities for maritime and marine sectors of the ocean space where the success lies in the Blue Economy sectors' ability to harness the technological, scientific and industrial capabilities offered. As such, the Blue Economy is foreseen to experience an exponential increase in productivity and innovation in each sector, which has to be guided by appropriate policy, legislation and conventions. The early

identification of technological applications scientifically and industrially will benefit decision makers, in line with the regulatory framework, to encourage investments in the Blue Economy sectors, but this can only happen if the correct strategy for its exploitation is put into place.

This chapter is centered on the Blue Economy and the technologies that support its activities. It serves as an attempt to indicate its direct and indirect impact. Insight into the absence of maritime diplomacy as a valid area of geopolitics through the inclusion of Marine Spatial Planning is provided as part of interrogating the success components of Smart Blue Economy activities in a common coastal zone around the continent. A background is crafted of the current Blue Economy status, the topic is introduced and an overview is given. The challenges of the Blue Economy are highlighted and how to strategically position for participation in its activities is given. The role and importance of Marine Spatial Management is defined, highlighted and emphasized. An overview for funding the Blue Economy is provided by discussing the current funding availability, the existing opportunities, the challenges and lastly some strategies on how to fund its activities and technologies. Technology is an aspect of life that infiltrated into all areas of life, it touches on the core of a nation's economy to the engine of individual companies' competitiveness by driving their performances and adding enrichment to people's lives including their workspaces like never before, necessitating the Blue Economy as a relative new concept in the world economy to hit the ground running, inclusive of the impacts of current and future technology.

Overview of the Blue Economy

The connecting factor between activities in the Blue Economy in its biological, political and economic nature, is water. The Blue Economy is widely advocated as a meaningful and sustainable strategy to save and benefit from the oceans. Thus, a rubric "cube" describes the Blue Economy best as it allows the reviewing of all actors in the space of water where constellations of actors are grouped for diverse purposes and within a specific framework.

The Blue Economy is thus an identifiable economy that features and implies a diversity of investing initiatives having a distinctive economy and environmental relation, (Winder 2014). This identification is a drastic point of origin as it involves the separation of the sea or water activities with its related value chains from the traditional national economy and builds at the same time new combinations of activities. Thus, the Blue or Oceans Economy poses a challenge to the adequate nature of the existing concept mappings and the assumption behind such.

The aim of this economy is to identify those new combinations of existing activities, as well as possibilities between the economic and the ecological environments. The aim goes deeper as Blue Economy is to stimulate new forms of economic behaviour within a biological framework and doing so in a sustainable manner.

Institutional investment initiatives into the Blue Economy will assemble actors around a specific combination of activities. Each Blue Economy initiative is to be regarded as experimental because of the specific combinations between the economic and ecological environments. Investment must take this into account.

For the Blue Economy to be a success, the reality needs to be accepted that there is a lack of vision, strategy and the tools to harness it. The Blue Economy can only be successful if it is treated as a social system created in a step-by-step process, which is a combination of this social system with strategic vision and practical tactics for implementation and measurement. This process is founded in articulate and precise crafting of the activities within the broader African scope, and drilling down to actual deployment of a Blue Economy agenda, which is aligned with inherently revolutionary development.

Marine Spatial Development

If Africa is to follow the African Union's Revised Maritime Charter and adhere to the United Nations Convention of the Law of the Sea of 1982, where landlocked countries have vested rights in the coastal areas of the continent, it will be required to plan the African coastal common space accordingly.

This is being taken up in the move for a Combined Economic Maritime Zone of Africa (CEMZA) and implicitly enhance the expansion of diplomacy as it is today in Africa, to include maritime diplomacy as a subject matter. The application of it in a practical manner is to be found in the principle of an uncommon discipline area for Africa, as that of Marine Spatial Planning.

Marine Spatial Planning is a process undertaken to design and allocate multiple usages by multiple users of the ocean space. It allows the capability to use the resources of the oceans safely (naval), sustainably (marine) and cost-effectively (maritime). In general, maps are drawn for specific and comprehensible depiction of a marine area with reference to the sea lanes (maritime); drilling, mining and harvesting (marine) and keeping peace (naval).

The goal is to plan and map a specific marine ecosystem and then to consider the cumulative effect that commercial, naval and marine activities will have on the ecosystem. It aims to make the different activities more sustainable and proactive to prevent possible conflicts between the different activities focused on the same ecosystem. According to UNESCO, MSP is a public process of analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic and social objectives that usually have been specified through a political process.

This thinking is now multi-faceted where multi-scaled connections, networks and relations of agencies in the ocean space are constituted by geographical patterns of operations and organizations. At the same time, it focuses on new processes and dynamics changing such across and within spatial contexts and the possible reterritorialization, and in the same case even the deterritorialization of oceans space being blocked off in sections of operations which may take place in such ocean space.

MSP promises itself as a forward-looking, strategic and integrated approach to allocating ocean space to different activities within the bounds of ecological limits and on an equitable basis as its foundation.

In practical terms, in the process of executing MSP, a comprehension plan or policy document is compiled and which is called the Master Plan, and usually of a long-term. This preparation is based on interactions with all relevant stakeholders and includes the spatial data collected for a particular marine area. The Master Plan then gets implemented through detailed ocean zoning maps which partition areas into different zones in which certain activities are permitted and other activities may be prohibited. The zoning maps come with regulations, a permit system to operate in the area and other regulatory tools.

The zoning maps need to be flexible and effective and leave not just sufficient room for the development of other activities in the zone partitioned, but also for growth of active industries. Revising of the Master Plan must take place regularly and associated zoning maps should be updated accordingly.

MSP should be considered as an aid to overcome the limitations of the current and future ocean management approaches. The approach depends on the design and implementation of the Master Plan in any national or regional context. MSP provides thus a basic understanding of the current uses of the ocean and screen out areas where potential conflict between activities may exist and areas where activities may co-exist. MSP may also assist in ensuring environmental protection by screening out areas that are of high environmental sensitive nature. MSP on the high seas is to undertake planning on a much coarser and less detailed level, as the MSP done for Exclusive Economic Zones around the continent.

Challenges of the Blue Economy

The Blue Economy presents itself as an opportunity to assemble separate maritime and marine activities in a multi-spatial and multi-user space. As it is to be organized separately and as an expert system, each activity when it reaches project stage must be critically assessed and with limited participation that should ideally be linked to due diligence processes.

In the Blue Economy the role of good governance is crucial. The debates around it are centered on the role of economic values for ocean environmental characteristics and ocean resources in sustainability management. It is even more pronounced in the African

environment where both lack of knowledge and the strategic social system hampers the Blue Economy, but also where the issue of maritime diplomacy is still untouched by the coastal African countries. This is deemed to include landlocked countries in Africa as per the United Nations Convention of the Law of the Sea of 1982.

This “whale” is that much of the marine and maritime linkages may be incorporated in coherent policies that string both their implications together across Africa buy imbedding it in the geopolitical diplomacy aimed at in the African Union’s Revised Maritime Charter. It brings, in essence, about a collective approach that allows for the seamless assertion of the Blue Economy activities, regardless of it being addressed in bits and pieces. It should then be deemed to be cemented in the role that Marine Spatial Planning would play in the combined economic maritime zone of Africa. This view encourages foreign investors in their decision making and choices, to be more reluctant when this approach is not in place, whilst indicating that it would flow easier if such is managed and regulated (Winder et al 2017).

One of the challenges is how to reduce carbon footprints, energy and food security. The rationale behind the emission trading scheme is to make those who emit carbon to pay for it. This needs to be taken into account with every activity planned for the Blue Economy, especially in Africa with its exploitation-rich and beneficiation- poor history.

Energy has a dual impact on people, namely on the one hand is the increased price of energy as established wells decline in supply and on the other hand is the effect that it should be government desire to increase oil exploration. Food security can be obtained by investing in more agriculture on land and in the oceans. Various water plants are edible and may even be used for animal fodder.

Another challenge is how the knowledge is produced as a matter of urgency which is a necessary step before pinpointing what questions to ask for any economic activity within

the ocean's environment. This points to not only the lack of research available but also the narrow scope of research that is available. This is an enhanced lack being mirrored in the absence of maritime diplomacy in African geopolitics as an agenda-pointed pursuance in resource negotiations with other continents.

A further challenge is that science and government policies are caught between the fact that first government departments ought to be reviewing their approaches to regulation and legislation that relates to any activity with the Blue Economy. Secondly, that the participatory processes must give investors better procedures which they can use to establish whether they have consent and adequate evidence before going ahead with applications for the proposed Blue Economy activities.

The lag in governmental participation in the active pursuance of the Blue Economy, brings about a lack of awareness from the private sector to engage in these activities, with research in the area pulling it forward, albeit at a pace that is less than encouraging. It comes from the fact that Africa is in its infancy stage with the concept of maritime diplomacy and its appropriate place in geopolitical arenas. This focuses attention on the skills development of governmental departments that are not including development of Blue Economy activities, neither the cross-cutting nature nor the potential that such activities have in store for countries. It creates a condition of blindness both on a local front as well as a continent front and is a serious hamstring in terms of international negotiations relating to it.

Strategically Positioned Blue Economy

South Africa has most probably a highly sophisticated maritime and marine industry when compared superficially with the rest of the African continent. It includes subsectors such as

shipping, maritime logistics infrastructure and transhipments. It also includes ports, coastal and marine service, with marine resources such as aquaculture. This is observed when reviewing, for example, the active role that its state-owned Transnet is playing in the continent by bidding to operate continental ports as part of an international strategy as port terminal operators and assuming capabilities that are rooted in Fourth Industrial Revolution technologies. Transnet International applies this as a competitive advantage in competing directly with developed countries' port terminal operators for ports operations across Africa. It is unique to South Africa, as yet, with flickering of same-minded thought processing as in the case of Nigeria, Mozambique and Angola giving concessions to private local entities for port operations. However, the components of Fourth Industrial Revolution's technologies are not highlighted for these countries as part of the awarding requirements in such bidding processes.

Fisheries and pharmaceuticals are aligned by government research institutions as a combined exploitation activity, implicitly positioning itself as a circular economy as the same catch of fish is emerging to be addressing both markets. This is visible in the research outputs relating to enhanced fish feed as well as development in marine probiotics for cosmetic purposes. It is linked to the market for aquaculture and has the potential of forming auxiliary markets for aquaculture produce.

South Africa also has boating and cruising, sports and recreation and leisure activities which comes as a surprise for an African country with its huge divides in income brackets. As such, South Africa is rated amongst the leading manufacturers of leisure craft. However, its serving markets tend to be outside the continental borders and forms part of luxury market. The country also does substantial marine research with several governmental entities performing such. One research area includes the development of nutrional supplements generated from sea plants for human consumption, which was executed by the Council for

Scientific and Industrial Research and rolled in schools in the Eastern Cape province of South Africa. This is an unusual move, in this direction and has the potential of finding continent-wide application if implementing sea plant harvesting as a supported Blue Economy activity by coastal African countries.

On the maritime side, there are signs of increased research based on the impact of Operation Phakisa, the presidential initiative for the country's growth in the Blue Economy. It is viewed as a specific mechanism to deploy the notion of the Blue Economy through specific approaches into the country's economy at large, within the boundaries of an emerging circular economy without stating it explicitly. This statement finds itself entrenched in the specific aim the initiative has and the quantified results it is seeking. The initiative is novel on the continent with the exception of Kenya and Nigeria, where at least, awareness of the Blue Economy is created through information campaigns attempts on a country-wide level, but is hampered by the cost such audiences have to lay out to participate in these attempts.

An interesting aspect of the initiative is that of maritime security expressed as marine governance as it is not historically actively pursued and most African navies are burdened with the role of coastal patrolling of ocean violations. Unfortunately, this is restricted to "catch and release" as most African coastal countries do not have the capability to prosecute and sentence such violations due to lack of such judicial systems. Only Kenya has prosecuted such violations, and only did so with the aid of the international maritime community.

Management of ocean related violations is a critical aspect to the success of the Blue Economy, as it manifests the value of it, not just in societal systems but also in its political systems and the history of Africa is embroiled in such violations. This gave birth to physical slavery to economic slavery and sitting stuck in political agendas that do not give rise to the

inherent value of Africa's geographical space. It is closely linked to its strategic undervaluation by its own people. Other manifestations of the strategic and economic value of the Blue Economy is that of coast-to-coast development corridors such as the Maputo Development Corridor and the Trans-Kalahari Corridor in Namibia and the development of coastal special economic zones, called industrial development zones (van Wyk 2015).

Africa has practical examples of somewhat strategic application of its inherent value to the international community and even though a comprehensive strategy is being preached by the African Union. It is hence not fair to make the assessment that a strategy is lacking, instead thus far everyone seems to agree that there is no agreement on what the strategy model is or should be. It is built on the premise that it means in broad terms to have a plan that must bring certain results (operations) achieved by doing some tasks (tactics), which is not obviously achieved by the Revised African Maritime Charter, perhaps due to it not being defined in its text along the lines of the model of the strategy being applied. There are three models of strategy, each defined differently.

The first model is that of Linear Strategy, where the approach focuses on planning goals to achieve and includes the means of achieving them and is seen then as the result of strategic management. This would be of greater value if applied on each African coastal country as it contains an element of goal quantification. It becomes an important geopolitical and specifically a maritime diplomacy tool for specific negotiation areas. The second model is that of Adoptive Strategy, where the organization makes changes as a response to changes in their consumer demands, where the opportunities and the risks related to it as well as the organization's resources and capabilities are taken into account. This strategy allows for a profile-based dynamic model that brings in the element of predicting changes in these aspects of the strategy and so plotting a path set by obtaining the changes made in the dynamics. The third model is that of Interpretive Strategy where the organization conveys meaning intended

to motivate consumers to favour that organization. It finds more application in developing country-awareness strategies in, for example, opening up job opportunities in the Blue Economy as well as supplying the demand for the produce of the Blue Economy activities. These strategies do not exclude each other, but should be viewed as a staggered approach in the development of the Blue Economy activities as a whole.

For the Blue Economy as its stands currently in Africa, it is clear that the second model of strategy, namely; Adoptive Strategy, is found to be the most applicable. Blue Economy is the result of changes in consumers demands in three different environments, driven by a higher middle-class population and higher demand for food and energy. By organizing the strategies in sequencing, the level of engagement by African coastal countries are identified as a starting point for strategy development and implementation. Two targets with engagement were identified and prioritized as strategic knowledge interventions; namely 1) linking social and ecological processes in framings that exceed a science view to quantify the social impacts and 2) restoring the oceans as an economy with economic practices that are always embedded in ecological conditions (Winder et al. 2017).

How to adapt to these demands and fulfil them, is the question that ought to be answered by what are the tools available to fulfil it. In this case, technology should be an enabler as an overarching tool. A closer look is taken to the kinds of technology available to serve as an enabling environment for the three Blue Economy environments, but firstly marine spatial planning is reviewed to show where each Blue Economy environment is active and how its activities are defined.

Funding the Blue Economy

The ocean is and remains a vast stretch of water that is the least developed, even though it is 75% of the earth's surface. This is slowly changing as the ocean is increasingly being viewed as an underexplored and possibly lucrative opportunity to create wealth. This realization is emphasised as investments that accounts better for environmental, social and governance risk. It includes investments that are based on a strong business case and where an improvement because of its activities may be found in the oceans' health. Lastly the investments made that are explicitly aimed at ocean health and health of ecosystems.

The Blue Economy's activities and the technologies that accompany it, is having an impact on how investment, regulation and governance is considered and adapted to investor requirements. The major shifts in geo-economic, cultural, social and political created a greater curiosity and yearning for understanding and possible involvement of the oceans. The idea of starting a new economy with existing activities already that prove to be lucrative, gives urgency to the matter. A need to reassess an economy and nature exists and forces a renegotiation between biological and economic relations that are connected to Blue activities on a global scale. The proposition of the Blue Economy is thus putting the spotlight on regulations and legislation that accompanies understanding of and involvement in such activities (Winder et al. 2017).

The Blue Economy needs firstly intervention at national and local governance level, the national level to issue regulations and legislation and the local level to execute them. Consideration based on Marine Spatial Planning must be provided for the interactions between social, economic and environmental factors within such framework where coastal

activities are integrated with. It needs intervention that allows for the production of sustained social benefits through the integration of the coastal areas with the aid of Marine Spatial Planning.

Lastly, it needs to monitor the three challenges, associated with carbon footprint, energy and food security. These outputs must form part of an assessment done to establish how deeply the Blue Economy is becoming entrenched in contributing alongside the traditional economy to the country's economic, political, geoscientific, ecological and social wellbeing.

In just creating awareness about the Blue Economy lies an opportunity. A further opportunity lies with the diligent incorporation of environmental, social and governance consideration, especially that the investments in the Blue Economy, are evolving.

Another opportunity is that traditional maritime and marine industries may gain significantly of the requirements to adapt and mitigate the impact of their activities. It may also shape and mould it into a higher focus on their economic versus ecological activities. Lastly, the opportunity to invest in ocean health and ecosystems can be directed as an opportunity in its own right. This brings about clarity that the Blue Economy is evolving with linkages to the traditional economy.

The first challenge in this, lies in the fact that the environment for ocean investments are changing. In order to manage this change in ocean investments, governments must lead with relevant legislation and regulation that must address an integrated Exclusive, Economic Zone (EEZ) with multiple activities taking place within the same demarcated area done by marine spatial planning. This may provide a level playing field for investors, whilst done correctly, greater certainty, transparency and stability will then encourage new investment.

The second challenge is that greater emphasis ought to be on the declining of the oceans' health, bringing about a change in the way companies operating in ocean activities must execute those activities.

The third challenge is that the oceans economy is diversifying with new forms of economic activity emerging. Significant opportunities are emerging from the three world problems which are the carbon footprint, energy and food security, however the skills to mine the opportunity is still emerging with low levels of capital investments.

The fourth challenge is that aquaculture and mari-culture is not enough to provide a solution to food security, but has to be done with wild capture fishing.

The fifth challenge is the slow development in having mining activities with near-shore dredging and the extraction of aggregates done for a long time already, but lagging in deep sea mining due to the nature of the availability of the technology involved and a lack of international standard set for it.

The sixth and last challenge is that of research that needs to be aimed at national resource efficiency and security, including alternative and renewable energy. Innovative funding has already been applied in the area but it requires an upfront risk for the involvement of development banks and export credit agencies.

With the stance of the global shipping industry, pre-emptive steps are taken on a daily basis to address future compliance issues. They also view it as a matter of social responsibility. It drives investment by these activities such as installation of ballast water treatment systems and from the global challenge of energy, and transitioning to cleaner fuel. The shipping companies undertaking this are already benefiting from the investments made.

Deep seabed mining has not yet taken off on a large scale, but is due for it has to be carefully done. It must be supported by environmental assessments, environmental management plans as well as a social impact assessment and a plan for that too. Companies that have these requirements in place, and applied for licensing, stand better chances of getting investments in their ventures. Due to deep sea mining being so undeveloped, gives companies an edge above the companies as they are able to "shape" the entire context for sector development towards the incorporation of sustainability, while enjoying the security of moving as a group (*The Economist* 2015)

Green bonds financial products are becoming a mainstream product and not a niche product anymore. Green bonds are created by the World Bank, followed by other banks. Their purpose is to act as the funding for environmentally sustainable infrastructure projects. This includes companies that need funding coastal protection and wastewater management. The funding is done by institutional investors who need to add investments linked with climate change mitigation and has adapted their portfolios to accommodate such.

Technologies of a Smart Blue Economy

Marine Spatial Planning is the first step in demarcating the areas in which Blue Economy activities can take place. The next question is what tools are available for smart Blue Economy activities. To establish the tools available, it should be understood that the common platform of tools is technology based and as such, this is what will be discussed.

This section largely addresses which tools may be used within the Blue Economy and how these tools may be used. All the tools in this section may be used for any of the Blue Economy activities, hence a limited number has been included even though there are many

other technologies available, such as optical character resolution. Importantly, is to note that even the manufacturing of the tools itself, is also an opportunity to review and present to potential investors.

The world has three problems or needs; namely reduce carbon footprint, increase food security and decrease energy needs. The tools being used as the technologies of the Blue Economy have to address one of these three in some way or the other, directly or indirectly. Carbon capture and storage involves a process where carbon dioxide emissions caused by human behaviour is captured before they enter the atmosphere and is then transported to geological sites where they are stored safely. The oceans provide a wide variety of food and medicine so the need for marine biotechnology has increased. The change in technology behind marine biotechnology provides opportunities in pharmaceuticals development of new industries. These technologies must proof to be a sustainable solution as a balance needs to be between what is extracted from the ocean, should be replaced and replenished.

Energy needs have changed and is shifting towards management that efficiently produced, efficiently stored, delivered and re-use. It means that especially in the storage of energy the ability to harness lightweight, high energy density fuel cells that are able to convert hydrogen into useable electrical energy will continue.

Sensors

This term covers a wide range of different devices on the market which are used to measure the physical environment in which commercial, naval and the marine environment may be operating. Sensor technology's growth is spurred by the growing demand for data and

information to continuously tailor service and product offerings to consumer demands (Lloyd's Register Ltd 2017).

Its rate of application in the Blue Economy will rapidly increase as the maritime and marine environments continue to find their place in the ocean space, driven by marine spatial planning. The sensors allow for operation in a network that is connected to a remote unit, focusing on data collection and processing, such as wireless sensors and the development of micro and nano sensors. Sensors will enable devices to work remotely by operating within a network connected to a remote unit for data collection and processing.

A robust wireless network and its architecture will be required so that sensors may be self-calibrating and have fault tolerance with high transmission capabilities. These sensors also require minimum maintenance, be wireless, made from environmentally friendly materials and have low energy consuming levels.

Autonomous Systems

The technology for autonomous system is rapidly expanding in its use as it can be applied in diverse situations. The area where it is expanding the most is air and automotive transport (Lloyd's Register Ltd 2017).

It can be used to remove people out of the process that involves dangerous, dirty and dull work, and because of that an increase of the technology application is expected in both maritime and marine worlds. The increasing use of technology and intelligent connectors such as the Internet of Things, will bring about stand alone and independent technologies that are intelligently connected to function seamlessly as one. This is, however, still way off for the maritime domain to move to autonomous above water and underwater systems, whilst in the marine sector it is a little bit more utilized.

The manufacturing of such systems, hardware and software, is an opportunity for investors and manufacturers. It requires new products and new services, opening the market for the entrance of small to medium sized companies and a diversification in large companies and investors' portfolios.

Robotics

A robot can be programmed to carry out complex tasks automatically. Tasks that relate from underwater to upper space can be done by robots. It may include assembly tasks, collaboration with humans regarding certain tasks and collaboration with other machines (Lloyd's Register Ltd 2017).

Different levels of decision making can be programmed into robots which may also be programmed for different environments in which to operate. Theses robots can be remotely controlled, supervised, collaborate with humans and machines or can be fully automated. Robots can be used in dangerous areas and so play a role in improving safety and hazard relief.

Currently robots should find application in a limited range of industries and organically grown into specific areas and niche applications. In the near future, it can be expected that remote controlled robots will emerge significantly before autonomous robots.

Robots can be differentiated in terms of the cognition ability of attention, dialogue, perception, memory retained and independent decision making. The senses of robots may include speaking, touching, seeing and listening. They may be versatile in having swim, fly and climb functions that provide a multitude of resources to onshore and offshore base stations. The imitation of robots where the recreation of human actions is done, will open new opportunities in its functions. It will also be adaptable in the function of carrying out specific tasks autonomously and allows it to function in subtropical to artic environments.

Communication

In the maritime and marine world, remote operation is becoming a widely spread trend. The technology for communication thus has gained importance as it is crucial for situational awareness and exchange of information between the different parties (Lloyd's Register Ltd 2017).

Communicational tools provide for emergency calls, disaster warning, geo-positioning and marine-life tracking. This increased diversification and capabilities of communication technologies form a key to unlock big data. Very High Frequency (VHF) installations, satellite systems and Wi-Fi are just examples of how widely adopted wireless communications are. Data is embedded and transmitted from one location to the next without the use of cables. However, to deploy the wireless communication is challenging as the shared spectra could become congested. Allocation of spectral band needs to be maximised with the aid of high order modulation, dynamic spectrum sharing and management as well as pulse shaping. Future communication will be driven by an increase in data transfer between offshore to onshore and offshore to offshore, having bases for optimal efficiency, safety and security.

Advanced Materials

This includes all materials that are engineered for a physical or specific function. It is a trend at the moment and around metallic, ceramic, polymeric and composite materials that are engineered to obtain improved capabilities such as strength, toughness, durability and other useful functionalities (Lloyd's Register Ltd 2017). It is done on the nano-scale level which are used to harness these properties in large structures. On other words, the characteristic of the material in use is enhanced by making adjustments on the nano-scale level.

Metals are still the dominant material being used in ship structures, however, there is an increasing demand for composites to replace metal in selected applications. Because natural organisms evolved and are still evolving to adjust to a changing environment that is becoming tougher, the bio-inspired material will out of nature, present chemical or physical attributes to protect the surface from external challenges. Such challenges will typically be abrasion, fouling and icing.

As competition increases between the shipping companies, almost all aspects of the company are reviewed, including the fleet. Composites prove to be a viable option above metals and can offer better mechanical properties and versatile functionalities to ease the fuel burden from ships. This leads to better energy economy and in some cases more cargo handling capacity.

Advanced Manufacturing

The economics of advanced manufacturing changed dramatically with the change in innovative technologies and materials and having this combined with an increase in consumer demand. This situation caused a rethink and a transformation of manufacturing, its processes and its equipment (Lloyd's Register Ltd 2017).

Additive manufacturing as a technology can be combined with robotics and through the assembly phase of the manufacturing makes it more competitive and productive. These are emerging and transformational technologies playing a role in business optimization. They will have and already have a major impact on manufacturers' ability as it brings about a change to less resource-intensive manufacturing techniques and produces lower cost products. Advanced manufacturing is all about the rethinking of traditional methods, techniques, approaches, supply chains and value chains. It also forms a new foundation for companies to enter industry with high end technology and advanced systems to cut down on

their costs significantly, but as with everything that becomes cheaper in time, the input cost is high.

Big Data Analytics

Big data is data so large and complex that traditional methods to analyse it, proves to be insufficient. The definition of it revolves around the volume of the data, its velocity and variety (Lloyd's Register Ltd 2017).

It is basically information assets that demand a cost-effective and innovative information processing for enhanced insight and decision making. There is a move towards including veracity, which refers to the accuracy and reliability of the data so analysed. With big data analysis, the aim is to find trends, patterns correlations, ambiguities and other useful information. It should be understood that greater volumes of data do not necessarily mean a better output of data.

The quality of data is more important as it is not at risk then to provide misleading results, leading to poor decision making. Mining data offers new knowledge and added value that would not have been uncovered by traditional data analytics. This allows strategy development to base competitive behavior, including that of pricing, on greater consumer satisfaction. It also has an impact into decisions that leads to gain greater market share sustainably.

It requires faster and more complex data processors, which includes the development of supercomputers and the arrival and implementation of cognitive systems. This will all be impacted on the bandwidth of the satellite services offered to the Blue Economy environments. Its benefits spread through all three environments, with each benefiting extensively from it. For the commercial Blue Economy environment, the benefit will stretch from strategy development through to operational execution, whereas for the naval

environment it will stretch from onshore to offshore stations and for the marine environment it will cover from seed to harvesting.

Big data analytics will make available different tactics to follow not only in the operations of the three environments, but also in optimizing the outputs of the operations, resulting in monetary compensation and sustainability of all three environments. A huge amount of data associated with the commercial environment of the Blue Economy is already produced on a daily basis from different sources and in different formats. It should however be clear that the economic and financial data produced can just be married into the ecological data also produced.

Cyber and Electronic Warfare

They are grouped together as they exist in both the maritime and marine environment. All the tools discussed in here involve hardware and software (Lloyd's Register Ltd 2017).

It refers to an intentional attack on software systems to intercept communication, disrupt it, distort it, deceive it and lastly to steal it. This is done to prevent the owner of the software, to receive optimum usage of it by sabotaging it. The intentions behind such acts can be up close and personal but also as a just business strategy. The importance of cyber-security-related technologies will grow, especially as malware or malicious software will find its way in doing business daily. It will evolve to become more sophisticated which means that early detection, sensing and encryption technologies can be expected to also grow in sophistication.

In parallel of the threat against the software, there is also a threat against the hardware as the electronic system that is associated with early detection, sensing and encryption as well as positioning and communication will increase in their vulnerability to attacks.

Electronic warfare refers to the situation where a manipulation of the electromagnetic spectrum is done, for the purpose of deceiving sensors and communications.

Unveiling the Value of a SMART Blue Economy

The value of a smart Blue Economy is related to the Value Chain each Blue Economy activity follows as it relates to its input factors and its output quantifiables, which are inclusive of its social impact.

The Blue Economy activities are of physical nature and hence require skills that translate into job creation, which is directly related to the development goals of Africa as a continent. It is an important indicator as job creation leads to wealth creation and impact on the poverty levels of a community, which in turn leads to food security and the fulfilment of basic needs, allowing for self-development of the individual in the affected community.

The Smart Blue Economy refers to the specific input factor of technology. This is divided into two aspects, namely that of the actual hardware required for a Smart Blue Economy and that of the application of the hardware of a Smart Blue Economy. Both bring about the relevant skills development to the process involved in the actual hardware and the application of the elements of a Smart Blue Economy. Moreover, it allows both aspects to be clearly defined in terms of its practical requirements and manifestations, silencing the esoteric value currently being ascribed to it. In activating the physical nature of the Smart Blue Economy, it relieves the concept from an abstract idea to a valuable continental tool by structuring it as a maritime diplomatic agenda that contains geopolitical elements, based on countries' profiles.

By shaping the Smart Blue Economy in linking it with traditional economics and politics, a measureable value that is reflected in societies, becomes a realistic, feasible and viable goal. This is especially true for Africa where the baseline is marginal when reviewing its development goals for countries. It has the potential of forming the very basis of how communities may be structured for poverty alleviation and wealth creation, provided it is always linked to a clearly stated result with a clear roadmap to follow and clearly identified playfields.

The Smart Blue Economy is a valid possibility as a mechanism for maritime diplomacy as well as an instrument for geopolitics, rooted in economic principles in a manner that allows for the correct strategy formulation to obtain such impacts on a continental playground.

Conclusions

The Blue Economy's value and worth will only be seen in the future, provided a roadmap with action plans and implementable policies and legislation accompanies it. This chapter attempts to review the Blue Economy in all its so far identified activities and accompanies it by the technologies most commonly used or, having the most potential use for the activity itself. The activities are highlighted and structured to comply with answering the three global problems of carbon footprint, food security and energy, as well as the World Bank's three concerns (Young, Michaela. 2015). They are that the current economic trends are rapidly degrading oceans resources, the lack of investment in human capital for employment and development in innovative blue economy sectors as well as the inadequate care for marine resources and ecosystems of the oceans.

This requires a finely balanced act between marine spatial planning and around the coastal areas, land spatial planning. This role cannot be amplified enough and yet it is still in its infancy, especially in African coastal countries. The chapter deals also with the challenges that the Blue Economy presents and how mitigating strategies may be found and implemented to obtain results by making use of the opportunities it so presents. It takes into account current available funding for Blue Economy activities and strategies to access such funding.

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