

Science, Research and Innovation for Harnessing the Blue Economy

A Partial Synthesis of Presentations Made at the Science and Research Symposium of the First-Ever Global Sustainable Blue Economy Conference, Held in the City of Nairobi, Kenya



SUSTAINABLE
BLUE ECONOMY
CONFERENCE

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Science, Research and Innovation for Harnessing the Blue Economy

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This publication is the result of a modest attempt to put together some of the presentations that the research and scholarly community made during the first-ever, global Sustainable Blue Economy Conference (SBEC) held in the City of Nairobi (Kenya) in November 2018. Whereas the editors have made every effort to summarise and synthesise what clearly came to light, the publication does not necessarily represent the views of the Government of Kenya and the Stockholm Environment Institute (SEI), or the official policy of any government, any institution or any individual mentioned or featured in the respective chapters. The chapters may be quoted or reproduced without charge, provided the source is duly acknowledged. All images remain the sole property of their source and may not be used for any purpose without the written permission of the source.

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Foreword

I am pleased to write a foreword for this publication, which highlights some of the key issues that were deliberated during the Science and Research Symposium of the historic Sustainable Blue Economy Conference (SBEC), hosted by the Government of Kenya in November 2018. The task of compiling and therefore having some form of record of some of the critical issues that were canvassed has been monumental for several reasons. One is that the processes usually associated with academic publications can be extremely tenuous, including communicating with authors who dispersed soon after a conference and urging them to submit final versions of their papers. That process sometimes does not produce results, but whatever its outcome, it is usually followed by the detailed tasks of compiling, reviewing, editing and, ultimately, finding the resources with which to publish.

Regardless, we at Kenya's State Department of Fisheries and the Blue Economy considered the Science and Research Symposium the foremost pillar of the Blue Economy Conference. For this reason, we decided that every effort should be made to produce a publication that in some ways, would reflect the spirit of science and research as an important catalyst for harnessing the resources of the blue economy. We wanted to provide a reference point for the 2018 conference. We believe this effort is not in vain, because it lays the foundations for creating the much-needed learning resources, solutions and policy recommendations that will ultimately guide the very harnessing of the blue economy as is ultimately intended.

For this effort to see the light of day, I am therefore immensely grateful to the Stockholm Environment Institute and the Government of Sweden for providing the seed funding that ensured we started the publication process. I would also like to commend the preparatory committee of the Science and Research Symposium of SBEC 2018 for volunteering their time and ideas to ensure that the Symposium attracted a record attendance of more than 1,500 participants. Last, but not least, I am immensely grateful to the patience and diligence of the editorial collective and the determination that has ensured we now have something to show from a major component of that international conference.

I must conclude by simply stating that, in view of the time between SBEC 2018 and the finalization of this publication, the volume has rightly taken the liberty to include and highlight some key initiatives already being implemented, in Kenya and by some global institutions, which were most likely triggered by SBEC 2018. The journey therefore continues.



Prof. Japheth Micheni Ntiba, Ph.D., DBA, CBS,
Principal Secretary, State Department for Fisheries, Aquaculture and the Blue
Economy Ministry of Agriculture, Livestock and Fisheries
Government of the Republic of Kenya

Preface and Acknowledgements

The publication of this book underlines my very strong conviction that scientific knowledge, and the unceasing quest for it, is the cornerstone of every human advancement. It is this conviction that drove me to insist that our hosting of the Blue Economy Conference in November 2018 would remain incomplete if we failed to rally the science and research community behind the cause. It therefore pleases me immensely to note that the task of coordinating this segment of the conference was delegated to my colleague, Professor Micheni Ntiba. He has not only delivered this book as an important part of the record of the event, but he was singularly able to transform what we had earlier planned only as a smaller event, into a fully fledged international academic symposium. Thus, it turns out that the Science and Research Symposium was one of the most well-attended, with a record of over 1000 attendees.

I believe subsequent pages of this book, and particularly Chapter 2, illustrates the critical role of science and research in ensuring the sustainable harnessing of the blue economy. As it is, sustainability which is a key deliverable of the Sustainable Development Goals era must be based, as far as possible, on the best available knowledge and scientific evidence. It behoves us to rely on academia to help us demystify the very concept of blue economy, while also empowering all citizens and enabling them to appreciate the value of the blue economy.

A key factor in all of this is the pre-eminence of collaborations and partnerships, particularly those between the private and public sectors so that innovative projects are conceived, financed and implemented to drive the blue economy of the world's least developed countries. Last, and by no means least, driving the research agenda of the blue economy requires concerted efforts involving various players, such as universities, government research institutes, non-governmental organizations (NGOs), coastal communities and even consultancy firms. I believe strongly, as emphasized in this book, that universities and research centres should prioritize their talent pipelines and encourage the reciprocal flow of ideas, while industry players should tap into the value found in the social sciences. The need to establish and sustain a global study and research network focused on the blue economy cannot be overemphasized.

On behalf of the Government of Kenya, I wish to acknowledge the generous contribution of the Stockholm Environment Institute's Africa Centre in supporting this publication. The compilation and editorial review of the work was undertaken

at various stages by a national editorial team comprising university academics from Kenya working alongside officials from the State Department of Fisheries and the Blue Economy and the Ministry of Foreign Affairs, who were all instrumental in the preparatory arrangements and subsequent hosting of SBEC 2018.

All in all, SBEC 2018 would not have been possible without the rallying support of several friendly individuals and countries, as well as many global and national institutions. I want to single out for special mention the governments of Canada and Japan who quickly responded to our requests and became co-hosts. This in no way underestimates the generous support, including sponsorship packages, that we received from a diverse list of countries and institutions, notably, China, Nigeria, Portugal, Qatar, South Africa, the United Nations Development Programme (UNDP) and the World Bank, to mention a few. At the national level, we received the support of the Capital Markets Authority, University of Nairobi and many other institutions.

Lastly, I want to thank His Excellency President Uhuru Kenyatta, who gave direct instruction that the Government of Kenya must take a leadership role in spearheading the harnessing of the blue economy and ensuring that the Ministry of Foreign Affairs properly took charge of the complex array of planning and logistics that such a huge conference required. In this regard, I want to also thank the staff of the Ministry of Foreign Affairs, who proved beyond doubt that, nationally and internationally, we do have the capacities, the determination, the skills and the resilience needed to make a major mark in global conferencing.

To one and all who supported the conference and all those who share in the vision of advancing the promise of the blue economy, I join in saying a big thank you to all of you.



Amb Macharia Kamau, Principal Secretary, CBS

Ministry of Foreign Affairs, Government of the Republic of Kenya

Acronyms and Abbreviations

| | |
|------------|--|
| AfDB | African Development Bank |
| AIMS | African Integrated Maritime Strategy 2050 |
| ANRC | African Natural Resources Centre, African Development Bank |
| AR | Augmented Reality |
| ASOA | African Ship Owners Association |
| AU | African Union |
| AU-IBAR | AU-Inter-African Bureau for Animal Resources |
| BCEs | Blue Carbon Ecosystems |
| BEIF | Blue Economy Investment Facility |
| BEICH & MF | Blue Economy Investment Clearing House and Monitoring Facility |
| BMZ | German Federal Ministry for Economic Cooperation and Development |
| COMENSUM | Community Environmental Sustainable Mariculture |
| EAC | East African Community |
| EEZs | Exclusive Economic Zones |
| FOCAC | Forum for China–Africa Cooperation |
| FAO | Food and Agricultural Organization of the United Nations |
| GBEF | Global Blue Economy Facility |
| GDP | Gross Domestic Product |
| GEF | Global Environmental Facility |
| GHG | Greenhouse Gas |
| GOOS | Global Ocean Observing System |
| GVC | global Value Chains |
| IDRC | International Development Research Centre |
| IOC | Intergovernmental Oceanographic Commission |
| IMO | International Maritime Organization |
| IUU | Illegal, Unreported and Unregulated |

| | |
|-----------|---|
| IUCN | International Union for the Conservation of Nature |
| IWM | Integrated Water Resources Management |
| KCDP | Kenya Coastal Development Project |
| KMFRI | Kenya Marine and Fisheries Research Institute |
| LDC | Least Developed Countries |
| MFA | Ministry of Foreign Affairs |
| MSME | Micro, Small and Medium Enterprises |
| MSP | Marine Spatial Planning |
| NGO | Non-Governmental Organization |
| NDC | Nationally Determined Contribution |
| OECD | Organisation for Economic Cooperation and Development |
| R2R | Ridge to Reef Restoration |
| SBEC 2018 | Sustainable Blue Economy Conference, 2018 |
| SDG | Sustainable Development Goal |
| SIDS | Small Island Developing States |
| STEM | Science, Technology, Engineering and Mathematics |
| UN | United Nations |
| UNCLOS | United Nations Convention for Law of the Sea |
| UNCTAD | United Nations Conference on Trade and Development |
| UNDP | United Nations Development Programme |
| UNEP | United Nation Environment Programme |
| UNESCO | United Nations, Education, Scientific and Cultural Organization |
| UNECA | United Nations Economic Commission for Africa |
| UNFCCC | United Nations Framework Convention on Climate Change |
| WIO | Western Indian Ocean |
| WMI | Wangari Maathai Institute |
| WWF | World Wildlife Fund |

Executive Summary and Key Messages

A brief introduction and background

This publication synthesizes some of the academic presentations made during the Science and Research Symposium of the first Blue Economy Conference (SBEC), held in Nairobi on 26–28 November 2018.

The book is organized into three sections with nine chapters and four annexes. The chapters have been designed to capture some, but not all, of the output of the presentations. They include contributions by researchers, academics and global institutional representatives from all over the world.

Book of abstracts simultaneously published

A key companion to this publication is the SBEC Science and Research (2018) *Book of Abstracts*. This will be published simultaneously to point readers to the immensely rich range of scientific and research outputs that the global scholarly community brought to the table during the 2018 event. However, like with many academic and research enterprises, collating the texts has been difficult; many authors unfortunately did not submit their full papers, hence delaying publication. Nevertheless, it is hoped that the contents therein, will point those interested in the evolving blue economy enterprise to some of the most important and promising areas of future research and attention. We also highlight scientific issues and concerns, which the global community must address if ‘the promise of the blue economy’ is to be fulfilled.

The Science and Research Symposium was deliberately fore-grounded by the conference organizers as a signature segment during SBEC 2018. This move was based on the conviction that research and knowledge production must remain a fundamental pillar in efforts to harness the blue economy.

Key sections and chapter summaries

Section 1 (consisting of **Chapter 1**) outlines in some detail, the full context and background of the Science and Research Symposium, including an outline of the Symposium’s objectives. This is situated within the broader context of the SBEC 2018 Conference which had nine closely related signature events. As the main convener of the conference, the Government of Kenya provided a robust definition of ‘blue economy’ that included its productivity and sustainability pillars, while also emphasizing the primacy of technology and innovation.

Section 2 (Chapters 3–7) provides a synthesis of the presentations that were made at the Symposium. It begins by exploring the central role of science and research in the blue economy.



HE Uhuru Kenyatta, President of the Republic of Kenya and chief host delivers his leadership commitment statement



HE Yoweri Museveni, President of Uganda delivers his leadership commitment statement at SBEC 2018.

Chapter 3, in turn, delves deeper into this issue and demonstrates the principle of ‘science at work’ through an incisive examination of the sustainable use of mineral and energy resources of the blue economy. It examines some of the critical investments that countries, especially those the Global South, must explore and consider, particularly with regards to the technological capacities required to reach and benefit from deep-sea mineral resources.

Chapter 4 examines the critical question of climate change in terms of climate actions, pollution and the ongoing global search for resilience and adaptation to this scourge of our time.

Chapter 5 discusses the pertinent topics of smart shipping, ports and the question of global connectivity. This is arguably one of the most critical agenda items of the entire SBEC 2018 because of its global socioeconomic–political and even specific trade ramifications.

Chapter 6 presents a snapshot of initiatives by people living in coastal communities. It addresses the pressing importance of inclusivity, in terms of communities, gender, and regional and global sensitivities.

In **Chapter 7**, the important subject of maritime security is examined. The chapter focuses mainly on the Western Indian Ocean, but also examines the critical maritime governance issues facing Kenya, Bahamas, Canada and Australia. The chapter sheds light on the vital global mechanisms that are in place to secure the blue economy, notably the Convention on the Law of the Sea, as well as measures that are required to delegitimize the preponderance of illegal, unreported, unregulated fishing.

In **Section 3 (Chapters 8 and 9)**, the publication looks beyond SBEC 2018 and reviews the influence of the conference, including initiatives spearhead-



HE Danny Faure, President of Seychelles delivers his leadership commitment statement during SBEC 2018



HE Mohamed Farmaajo, (Federal President of Somalia) delivers his country's commitment statement

ed at both national (Kenya) level and globally. Particularly significant initiatives include the Africa Blue Economy Strategy, developed by the African Union working with African Member States; the integration of the blue economy into the African Development Bank's 10 Year Strategy; the United Nations Ocean Conference in Lisbon, Portugal; the launch of the High-Level Panel for Sustainable Ocean Economy. Perhaps most notable are discussions to establish an all-encompassing, semi-independent, Blue Economy Clearing House, whose salient features were presented at the conference and elaborated upon further by key stakeholders after the conference. All of these are part of efforts to realize the promise of the blue economy (**Chapter 9**).

Overall, the publication is enriched by the inclusion of illustrations and other infographics that many presenters used during the conference. The publication ends with a key annex, the **Nairobi Statement of Intent on Advancing the Global Sustainable Blue Economy**. This records the key commitments from the global community. The statement should compel all of us to fulfil our commitments and advance the blue economy for the sake of both present and future generations.



Mr KitaK Ilam-Secretary General of the International Maritime Organization delivers a leadership commitment statement at SBEC 2018.



HE Filipe Nyusi, (Mozambique) delivers his country's commitment statement.



HE Moussa Faki, chairperson of the African Union Commission delivers the AUC's commitment statement.

Key messages of the Science and Research Symposium

The following key messages resonated throughout the Science and Research Symposium:

- **Solid science:** Solid science on the blue economy must be developed. This requires relevant networks to be built within and among academia and industry's key players.
- **Multidisciplinary and transdisciplinary approaches:** Multidisciplinary and transdisciplinary approaches to studying the blue economy should be strengthened. These approaches must be supported by necessary financial resources.
- **Academic entrepreneurship:** Academic entrepreneurship should be emphasized and strengthened. This includes investment in capacities that enable scholars and academics improve their proposals and research, and hence make a greater contribution to blue economy sectors.
- **Data revolution:** Investment in data technologies is needed in order to improve the social, economic and environmental conditions for all blue economy-based resources.
- **Marine spatial planning:** Marine spatial planning is critical to enhancing a sustainable approach to adaptive management of marine ecosystems.
- **A multilateral research infrastructure:** A multilateral research infrastructure should be established to address common challenges, shape international partnerships and create monitoring systems for tracking baseline data. This would strengthen regional and country capacities.
- **Collaboration between policy makers and researchers:** Policy makers and researchers must work together to improve policies and strategies to develop a sustainable blue economy.



Japan Minister HE Mr. Masahisa Sato, delivers his country's commitment statement.



Mr. Keriako Tobiko, Cabinet Secretary, Ministry of Environment and Forestry, Kenya delivers his ministry's commitment statement.

- **Social science and ecosystem-based approaches:** Social science and ecosystem-based approaches are needed in order to restore marine ecosystems and support community projects that enhance the blue economy.¹

Challenges identified

In terms of delivering the promise of the blue economy, the Science and Research Symposium identified various challenges, notably the following:

- Poor coordination in the planning and implementation of blue economy-related initiatives;
- Maritime insecurity, specifically, the ever-evolving forms and scope of treaties, including intrinsic definitional problems, which, in themselves, pose various challenges to existing mechanisms to address them;²

- 1 Most of these key messages have been gleaned from, a presentation on 'The inclusive blue economy: integrating humans and nature into ocean science for management, governance and opportunities' that was given by Dr Alida Bundy of the Bedford Institute of Oceanography, Dartmouth, Canada.
- 2 See symposium abstracts by, among others, Njoki Mboce on 'Tenacity of maritime security threats: Case for a more effective multilateral enforcement system'; Peter Kagwanja on 'Maritime security and the blue economy: A knowledge and research agenda'; Constance Gikonyo on 'Criminalisation of maritime piracy: A challenge to maritime security, safety and enforcement'.



Amb. Monica Juma the then Cabinet Secretary for Foreign Affairs Kenya addresses delegates during the High Level segment of SBEC 2018.

- Climate change, especially its negative impacts on blue economy resources, and the increasing stress it places on marine ecosystems and the loss of biodiversity;
- Limited sharing of data, information and intelligence, and other outcomes of research processes.

Opportunities

The Science and Research Symposium recommended opportunities which could be explored, including:

- **Partnerships:** The forging of partnerships for science and research in the various sectors of the blue economy;
- **Simple innovations:** Developing and encouraging simple innovations aimed at addressing complex blue economy challenges, such as pollution and climate change, some of which were showcased at the conference;
- **Community involvement:** the encouragement of ‘bottom-up approaches’ to mainstream community involvement in the blue economy;
- **International and regional agreements:** fidelity to, and the implementation of, international and regional agreements related to the blue economy.

Conclusions and policy recommendations

- **Investment in science:** Invest in science, research and development to generate data, knowledge, information, new technologies and innovations for a sustainable blue economy.
- **An international platform for blue economy data generation:** Fast track the creation of an international platform for blue economy data generation and sharing, in order to address common challenges, as well as strengthen regional and country capacities.
- **Models and incentives:** Develop appropriate models and incentives to drive research-based industrial development.
- **A blue economy facility:** Establish a blue economy facility to foster international partnerships, while also strengthening monitoring systems for tracking baseline data.
- **Blue economy in the education curriculum:** Integrate the blue economy into the education curriculum to bridge the skills and knowledge gaps on a sustainable blue economy.
- **Collaboration:** Foster collaboration between relevant stakeholders in order to develop evidence-based policies and market-informed strategies.
- **Simple innovations:** Develop simple innovations to address ecosystem stresses and other complex blue economy challenges, such as pollution, climate change and overfishing.
- **Dynamic approaches:** Create dynamic approaches to enhance maritime safety and security and strengthen existing international collaboration.

A wooden boat with a canopy is on the ocean. The boat is dark brown with a light-colored canopy. It has a mast and some equipment on board. The water is blue and slightly choppy. In the background, there's a small boat on the horizon under a clear sky.

SECTION 1

Introduction and Background Issues

Chapter 1

Background, Overview and Introduction


1.1 Aims and objectives of the Science and Research Symposium

In November 2018, Kenya took the bold and historic step of hosting the very first Global Sustainable Blue Economy Conference (SBEC 2018).³ As will become apparent from other sections of this publication, the entire conference was historic, partly because of its sheer size. It was described as a ‘ten in one’ conference by Ambassador Macharia Kamau, one of the Symposium’s principal promoters, who represented the Government of Kenya (Kamau, 2018).

The Science and Research Symposium was conceptualized and executed as one of the ten signature events of the conference. Participants in this segment of the conference were expected to be primarily from national (Kenyan) and international academic research institutions, international and regional organizations, United Nations (UN) agencies and development partners, representatives of industry and the private sector, NGOs and civil society organizations.

The core objective of the Science and Research Symposium was to act as a forum for scholars and researchers to debate and share ideas on the complex scientific issues surrounding the blue economy. Put differently, the goal was to ensure that SBEC 2018 tapped into the probable and potential contributions of academic and research institutions to harness the blue economy’s resources. In this respect, participants were expected to share ideas and discuss critical scientific research topics and, where possible, share insights on new and cutting-edge technological advances, including best practices gleaned from other experiences. The conference organization recognized that institutions committed to excellence in teaching, learning, research and innovation are pivotal in efforts to build a sustainable and prosperous future, particularly regarding the use of marine and inland water resources. Research institutes and academic institutions play a vital role in providing training for both current and future generations, including those in the fields of natural sciences and technology. These are fields which provide the foundations for the responsible development and stewardship of marine and inland water resources. Specialized knowledge of how the oceans and inland water

³ Earlier global conferences relating to these issues tended to be canvassed around oceans, much to the detriment of nations whose main water sources were inland or in lakes.



bodies work is therefore crucial to advancing in marine technology, the sustainable economic development of marine and freshwater resources, and the protection of coastal and offshore environments.

Although academic institutions should pursue targeted research to foster discovery and develop technological and management tools for a sustainable blue economy, to truly thrive, they must also remain centres of pure, curiosity-driven research. They must continue to be reservoirs of scientific knowledge that may, or may not, have immediate application. They must remain frontiers of new discoveries that will address future environmental issues. The knowledge economy will then form the basis and foundation of the blue economy. The need to be part curious and part focused on specific subjects explains the somewhat eclectic, if not extremely tentative nature, of the submissions that were made at the Science and Research Symposium. Most of these are reflected in this publication.

1.2 The primacy of technology and innovation

As academic and research institutions devise innovative thinking and cutting-edge technological advances, and as societies develop, the economic use of the ocean and other inland waters expands and diversifies. Opportunities, therefore, come from technological advances that, if implemented within a framework of sustainability, can develop the nascent blue economy. For example, tides, waves and wind can provide ‘green energy’, while aquaculture, including its new applications onshore and in open waters offshore, can potentially provide sustainable high-quality food to supplement capture fisheries. Modern technologies can be used to exploit previously inaccessible resources, such as hydrocarbons and minerals in the deep-sea and other extreme environments. Advances in shipping technology can greatly increase the efficiency and safety of marine transport and reduce emissions and pollution. This can include unwanted transport of invasive species in ballast water. Put simply, technology and innovation are major factors in enabling countries to reap the dividends of the blue economy.

1.3 Challenges and opportunities

However, the use of marine and inland water resources does present challenges, especially if long-term sustainability is not factored into the development and implementation of new technologies. In particular, it is imperative, but also difficult, to minimize risks that are at the forefront of such developments; for instance, the depletion of resources and degradation of ecosystems through overfishing or destruction of habitat and pollution. Pollution can include eutrophication, industrial wastes, endocrine disrupters and oil spills, and invasive species that



Delegates streaming in for the high level segment of SBEC 2018 at the Kenyatta International Convention Centre, Nairobi.

can compromise industrial cooling systems, overtake ecosystems or interfere with aquaculture through toxicity or reduction of yields. At the same time, these issues need to be considered in the context of other non-anthropogenic impacts. Coastal erosion exacerbated by storm surge and the hazards of wind, waves, currents and ice are often present in the broad range of extreme environments where marine operations are conducted. Global climate change, therefore, complicates risk management and environmental stewardship. This is because the economic use of marine resources is expanding rapidly, while the ocean and its ecosystems are changing, and are increasingly influenced by human activities at local, regional and global scales.

Academic and research institutions have unique roles in engaging and partnering with broader society locally, nationally and internationally. The scope of engagement is broad and can be fostered through strong partnerships with government



Amb. Peter Thomson, UN Secretary General's Special Envoy for the Oceans (right) being escorted to the plenary hall of SBEC 2018 at the Kenyatta International Convention Centre, Nairobi.



Kenya's (immediate former) Foreign Affairs Cabinet Secretary Amb. Monica Juma welcomes a delegate prior to the SBEC 2018 opening ceremony at Kenyatta International Convention Centre, Nairobi, Kenya.

and NGOs, industry and other academic institutions (both nationally and internationally). Building synergies is clearly the hallmark of these partnerships and, for ocean studies in particular, new technologies, knowledge and management strategies are the result. This can lead to an improved framework for prosperous and sustainable relationships of humans with the oceans, seas and inland waters.

As an emerging area with much to be researched, the programme structure for the Science and Research Symposium provided the spark for a high-level opening discussion. During this the diverse range of participants highlighted some of the key issues animating research on the blue economy. The high-level session was followed by panel discussions focused around four thematic areas that were prioritized based on SBEC 2018's nine overarching sub-thematic areas and four cross-cutting issues. The contributions synthesized in this publication therefore focus on the following:

- the sustainable use of water resources (minerals, natural gas/oil, and fisheries) for poverty eradication, job creation and sustainable food supplies for humanity;
- climate action and resilience, waste management and conservation of water resources and ecosystems towards pollution-free water bodies;
- global connectivity and transportation via shipping lines, maritime safety and security and a sustainable regulatory regime; and,
- the blue economy and sustainable cities, tourism, infrastructure and culture.

Scholars and industry practitioners were encouraged showcase and exhibit cutting-edge technologies and innovations. Several of these featured in the Great Court of the University of Nairobi and in the exclusive exhibition tents (Common Market for Eastern and Southern Africa grounds) of the Kenyatta International Convention Centre. A glimpse of some of the exhibits at the SBEC is given in the pictorial annex section of this publication.

1.4 The envisaged outcomes of the Science and Research Symposium

The Science and Research Symposium envisioned eight possible outcomes:

- identification of research areas and options, within the blue economy agenda;
- establishment of new networking opportunities, partnership and collaborative programmes;
- formation of a blue economy Research and Innovation Network for Africa and the Global South;
- recommendations on how to strengthen research, technology, capacity and innovation in all sectors of the blue economy under the overall global theme of ‘more science for blue economy’;
- enumeration of possible subsequent build-up activities and collaborations to further blue economy dialogue and partnerships within the international community;
- production of a Scientific and Research Symposium Summary Report in preparation for the 2020 UN Oceans Conference;⁴

4 Due to the sudden outbreak of the COVID-19 pandemic, the 2020 UN Oceans Conference did not take place, and has been rescheduled to June 2022.

- (vii) recommendation of mechanisms for the establishment of a blue economy research and technology fund; and,
- (viii) publication of Symposium's discussions or proceedings of the conference.⁵

It is hoped that this publication, at the very least, draws attention to some of these key outcome areas that academic and research institutions worldwide – in partnership and collaboration with the global community and respective UN Member States, private sector and other stakeholders – will want to pursue in the coming years to fully realize the promise of the blue economy.

1.5 Defining the blue economy and the search for a global consensus

Although the very concept of the blue economy is still awaiting greater global consensus, the Nairobi Conference adopted and accepted a definition that is rapidly gaining currency. Hence, the blue economy seen as:

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The productive pillar of the oceans, seas, lakes and rivers, including fisheries, aquaculture, tourism, transport, shipbuilding, energy, bioprospecting and underwater mining, as well as all-related activities. (SBEC, 2018b)

Moreover, the conference was predicated on the two conceptual pillars of:

- (i) sustainability, climate change and controlling pollution;
- (ii) production, accelerated economic growth, jobs and poverty alleviation.

While the conference acknowledged the wavering consensus around the definition of the blue economy, it was also broadly accepted and understood as an economy that is largely powered by oceanic and marine resources. The term 'blue economy', itself, was originally pioneered by the Alliance of Small Island Developing States and has rapidly gained momentum across the world.

Today, oceans, and marine resources more generally, are acknowledged to play a prominent role in advancing sustainable development. They, therefore, formed the basis upon which the UN Heads of States and Governments adopted the 2030 Agenda for Sustainable Development which includes Sustainable Development Goal (SDG) 14. This goal rallies the global community around the need to 'conserve and sustainably use the oceans, seas and marine resources for sustainable development'. The sustainability pillar concerns sustainable exploitation and management,

⁵ See SBEC (2018a); in a sense, this publication fulfils this particular outcome.

addressing ocean pollution, adverse impacts of climate change, acidification, coastal erosion and the loss of biodiversity. It was widely agreed that the productive pillar needs to be enhanced since its full potential remains largely unfulfilled, especially in developing countries. People-centric investments are needed to optimize the benefits of the oceans and marine resources. Equity, inclusive growth and the other interests and concerns of developing countries should be reflected in the development of seas beyond national jurisdictions. Above all:

Oceans are the means of transport for 80% of global trade by volume and over 70% by value (UNCTAD, 2012). Two-thirds of energy supplies are carried by sea and there is, still, vast untapped potential for renewable blue energy production from wind, waves, tidal, thermal and biomass sources. Oceans also provide 32% of the global supply of hydrocarbons. (Clause 3.2.4 of SBEC, 2018b)

Human activities within exclusive economic zones (EEZs) are regulated by state, regional and international law, but in the high seas they are not properly regulated, leading to ‘the tragedy of the commons’.⁶ In light of this, there is need for collective efforts to address the challenges and to share the benefits. Maritime security is an enabler of a sustainable blue economy. Safe and secure waters are necessary for those working and living off the oceans, seas and lakes. Maritime security is also a source of economic development and growth. A vibrant blue economy demands enhanced maritime security capabilities, which in turn causes greater investment and growth in those capabilities.

1.6 Impacts of climate change and pollution on global blue economy

Oceans cover over 72% of the Earth, but 97% of this water is salty. In addition, oceans regulate global climate and temperature, and so support many diverse forms of life. They are estimated to have absorbed 25% of human-induced carbon dioxide since the Industrial Revolution resulting in a 26% increase in ocean acidity. The acidity has reduced the ability of oceans to absorb more carbon dioxide, therefore undermining marine ecosystems through changing ocean chemistry. Oceans provide a substantial portion of the world’s food. Aquaculture is the fastest-growing food sector producing about 47% of the fish consumed globally. However, 87% of global fish stocks are already fully or overexploited. Globally, 350 million jobs are linked to marine fisheries.⁷ There is, therefore, little doubt that the blue economy holds huge untapped potential for eradicating poverty, providing full employment and decent jobs, and addressing environmental challenges.

6 This term originates in economics and was popularised by Garrett Hardin (1968). It essentially references the over-bearing selfish, self-centred interests in which resources that are meant to be shared by the entire global community are gradually depleted by human beings who are acting solely in their own interest. But see also Bodansky (2012).

7 For some of these facts, see IUCN’s seminal expertise and resources on ‘the ocean and climate change in Herr and Galland (2009).

The growing global human population, intensification of agriculture, and rapid urbanization and industrialization have contributed to higher levels of pollution in oceans, seas, lakes and rivers. Human activities are contributing to significant warming trends and reduced ocean productivity. In addition, increasing pollution is contributing to the loss of biodiversity. Unfortunately, coastal and island populations continue to be vulnerable to climate extremes, ocean acidification, sea-level rise, fluctuations in ocean circulation and salinity, and other climate change impacts. It is estimated that by 2050, 50–200 million people will be displaced due to the negative impacts of climate change (Brown, 2008). The natural capital of many marine and coastal ecosystems has been degraded, impacting the provision of services and livelihoods. Approximately 20% of the world's coral reefs have been lost and another 20% degraded.⁸ Mangroves have been reduced to 30–50% of their historical cover.⁹ Since the late 1800s, 29% of sea grass has disappeared (University of Maryland Center for Environmental Science, 2009).

Coastal tourism is the largest market segment in the world economy, comprising 5% of the global gross domestic product (GDP) and about 7% of global employment. However, marine and coastal tourism has brought with it increased greenhouse gas (GHG) emissions, pollution and marine debris. Marine debris, plastic materials and micro plastics threaten the integrity of marine food chains. Documented dead marine zones now number over 405, covering an area of over 240,000 km². Mitigation and adaptation must therefore be enhanced to provide increased support for emergency preparedness and disaster response, as well as early warning systems, observations, and coastal planning and management.

1.7 International initiatives relevant to the blue economy

The Global Ocean Commission worked between 2013 and 2016 to raise awareness, while the Global Partnership for Oceans has been operating since 2012. Under the Global Partnership initiative, the World Bank Group expressed its commitment to finance, investments and policy reforms that unlock the potential of ocean resources for food security, as well as for poverty alleviation. One example of this is **the Program for Fisheries and Aquatic Resources**, which has been replenished in a broadened capacity.

The UN Secretary General's Five-Year Action Agenda, 2012–2016 and the 10X20 initiative, launched in 2015 by the Government of Italy and the Ocean Sanctuary, aimed to mobilize UN Member States to achieve target 5 of SDG 14. The initiative

8 More recent literature from the Reefs Resilience Network (<https://reefresilience.org/reefs-are-at-risk/>), suggests the situation is much more dire and that if remedial measures are not taken, 'the percentage of threatened coral reefs worldwide will rise to 90% by 2030 and close to 100% by 2050'.

9 See <https://www.thebluecarboninitiative.org/about-blue-carbon>

comprises 10 UN Member States and 20 lead scientists whose aim is to restore and sustain the world's oceans, as set out in target 5 of SDG 14: 'conserve, by 2020, at least 10% of coastal and marine seas, consistent with national and international law based upon best available scientific information'. In 2018, the initiative was co-chaired by the Bahamas, Kenya, Palau, Poland and the Ocean Sanctuary Alliance. In March 2016, as part of the initiative, a Scientific Symposium on Marine Protected Areas, organized by the Government of Italy, the Ocean Sanctuary and the UN Environment Programme was held in Rome. The outcome of the meeting was the 'Rome Call to Action', which was intended to support the achievement of SDG 14, target 5. In the meantime, the US Department of State convened three Our Ocean Conferences in 2014, 2015 and 2016, while the European Union convened the fourth in Malta in 2017. A fifth Our Ocean Conference was held in Bali, Indonesia, on 29 and 30 October 2018. The sixth took place in Norway in 2019, followed by the seventh in Palau in 2020.

Under the auspices of the UN, Fiji and Sweden co-hosted the first-ever UN Oceans Conference in New York on 5–6 June 2017 to advance the implementation of SDG 14. The second UN Oceans Conference will be co-hosted by Kenya and Portugal in Lisbon and is planned for June/July 2022, depending on the status of the COVID-19 pandemic. On 5 December 2017, the UN declared that a Decade of Ocean Science for Sustainable Development would be held from 2021 to 2030. The Ocean Decade provides a common framework to ensure that ocean science can fully support countries in achieving the 2030 Agenda for Sustainable Development.

1.8 How SBEC 2018 re-defined global conferencing

SBEC 2018 was unique in the way that it was organized. A conscious decision was made to include a distinct focus on science and academic research in the programme. The organizational structure and conduct of practically every segment of the conference, beginning with a leadership segment, provided particular moments for reflection, which are explored in this overview section. The programme was designed to permit as many participants as possible to follow through with the conference proceedings; consequently, nearly a dozen sites and venues hosted conference events. For the first time in a global gathering, there was a conference hall in which heads of state and governments, ministers and senior UN officials sat in theatre style without name tags or country flag designations. An innovative and invisible 'Voice of God (VoG)'¹⁰ was all that was needed to introduce and call speakers onto the stage, doing away

¹⁰ Modelled along the ancient Graeco-Roman theatre tradition the VoG as a modern conferencing technique dispenses with the common idea of a visible stage master of ceremonies who is then replaced by a well-rehearsed and professionally choreographed programme coordinator speaking through speakers from an invisible section of the conference hall. It is the coordinator's voice that booms across the hall, introducing speakers and making necessary announcements interspersed with pre-prepared theme-focused video clips.

with the more familiar practice of a master of ceremonies. Quite significantly, SBEC Speaker Guidelines had been sent out much earlier with the clear instructions on the length and focus of statements. There was simply no room for empty rhetoric, other than the sharing of commitments and pledges to the blue economy. To add to the drama, every session and speaker was welcomed to the stage with an interlude of carefully selected thematic videos that added to the ambience and colour, leaving many of the participants in clearly visible awe! There is little question that the literal staging and theatre-style production of SBEC 2018 merits a separate report because it allowed so many distinguished delegates to be able to speak at the conference and be part of the history that was being made.

1.9 About this publication

This publication is an attempt to piece together the key thematic issues and concerns that featured prominently at SBEC 2018's Science and Research Symposium. It also includes chapters discussing some of the initiatives already taken, particularly by the host country (Kenya) in advancing the blue economy agenda. As was only to be expected, one key purpose in convening SBEC 2018 was to trigger, on a global scale, the sustainable harnessing of what the publication categorically refers to as the 'the promise' of the blue economy. Some features of this are highlighted in the concluding chapter of this publication (Chapter 9).

Overall, this publication is mainly a synthesis of the issues and some of the ideas that were discussed by researchers and scholars. It is, therefore, complementary to the *SBEC 2018-Book of Abstracts*, which is to be published separately¹¹. In instances where full academic papers were made available (Chapters 3, 6 and 7), they have been revised appropriately with inputs from the respective authors, and published with their permission in order to address and contribute to the advancement of scholarly work on the blue economy-related issues and concerns.

In other instances, the editors reviewed and synthesized emerging issues largely from the deluge of Microsoft PowerPoint presentations and rapporteur notes in order to extract and highlight the key messages. It is hoped that this effort will lay the foundations for full articles, including further research in the areas that the researchers robustly canvassed. If this publication succeeds in pointing to the science and research issues that are vital to the productive and sustainable harnessing of the blue economy's resources, while also mapping the agenda as laid out by the pioneering research community that gathered in Nairobi in November, 2018, it shall have fulfilled its modest purpose.

¹¹ The SBEC 2018 Book of Abstracts will be published separately in order to record for posterity, not only the huge range of global representation that the conference attracted, but more importantly, the extremely wide range of research and scientific topics and issues that were canvassed and which merit further attention in the years to come.

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The background of the slide is a photograph of a coastal scene. In the foreground, a woman wearing a brown and white striped headwrap is looking down. To her left, a white boat is partially visible, with a woven basket on top. The water is a mix of light blue and green, with some white foam. The sky is a pale blue.

SECTION 2

A Synthesis of Key Presentations Made at the Science and Research Symposium Segment of SBEC 2018

Chapter 2

Perspectives on the Place of Science and Research in Harnessing a Sustainable Blue Economy

2.1 A role for science and research in the blue economy

This chapter aims to locate the role of science and research in securing a sustainable blue economy. As mentioned in the previous chapter, the views synthesized in this chapter are largely based on the presentations that were made at the Science and Research Symposium segment of SBEC 2018. The overriding message was that the sustainable blue economy management decisions should, as far as possible, be based on the best available knowledge as already upheld by the Scientific Committee on Oceanic Research.¹²

From the perspective of the Symposium, the role of science and research mainly involves the following:

- demystifying the blue economy by understanding what it is, how it can be measured and what it means for research;
- enhancing the potential for collaborative research, involving players in private and public sectors to develop innovative projects as a driver for the blue economy; and,
- building inclusive, interdisciplinary networks for blue economy research.

Concerted efforts are needed to drive the research agenda of the blue economy. These should involve various players, including universities, NGOs, government research institutes and consultancy firms. Universities should encourage the reciprocal flow of ideas, while industry players should tap into social sciences. Research outputs are shared in the form of research papers, research reports, conference proceedings, popular articles and policy briefs. However, a global network of the key players in the blue economy should be established and sustained, as this will enhance pooling of resources for science.

¹² For more on the Scientific Committee on Oceanic Research's work, visit <https://scor-int.org> and <https://council.science/what-we-do/affiliated-bodies/scientific-committee-on-oceanic-research-scor/>




Students watch Blue Economy films and other exhibitions mounted outside the University of Nairobi, venue for the Science and Research symposium.

The focus of research on the blue economy for Kenya falls into several categories:

- innovations and human capital research
- pollution research
- mapping and spatial planning of living and non-living marine and freshwater resources
- climate change
- climate action
- climate resilience and blue economy
- property rights and blue economy.

2.2 Sustainable oceans and science

Healthy marine ecosystems act as habitats for a large number of marine species and deliver essential services to humans, such as food, medicines, sources of clean energy, climate regulation, tourism, recreation, coastal protection and job creation. Despite covering about 70% of our planet and providing such essential services and goods, much still remains unknown about oceans. Recognizing the



critical role played by science and that the existence of humankind is highly dependent on a healthy ocean, Kenya conceptualized and hosted the first Global Sustainable Blue Economy Conference in November 2018, co-hosted by Canada and Japan. The theme was ‘The Blue Economy and the 2030 Agenda for Sustainable Development’. SBEC 2018 resulted in the ‘Nairobi Statement of Intent on Advancing a Sustainable Blue Economy’. One key commitment was strengthening science and research to generate and disseminate evidence-based knowledge and information. Further, it was emphasized that to be able to deliver sustainable oceans for present and future generations, strong scientific research to inform management and development is required. Science provides the capability to broaden our understanding and monitoring of the ocean’s ecosystems and their resources. Scientific investigation considers the new knowledge that needs to be created to bridge gaps in several areas of oceanic studies. Science is crucial in steering global efforts towards realizing a sustainable ocean by providing solutions to tackle the challenges that threaten the health of the oceans and their resources (OECD, 2019).

During SBEC, the Intergovernmental Oceanographic Commission of the United Nations Education Scientific and Cultural Organization (IOC–UNESCO) Secretary General, Dr Vladimir Ryabinin, stressed the need for knowledge-based planning and development for the blue economy to be sustainable. Having reliable scientific data and information will lead to a better understanding of the dynamics in the oceans for a better economic development. To make progress in this area, there is a need for new public–private partnerships that will identify user needs in ocean research, innovation and technological solutions intended to support sustainable approaches to the management and development of the oceans. It is forecast that by 2030 most of the investment in ocean science will be from private rather than public funding (OECD, 2019). Thus, it is of paramount importance that the scientific world start building partnerships with the private sector. Dr Ryabinin further stressed the need for science to have a relationship with the world enterprises in order to spur more innovation for the blue economy. New frontiers will include, but should not be limited to, artificial intelligence and robotics in ocean observation.

Unlike the terrestrial environment, the oceans represent a more challenging environment to work in. Many of the economic activities around the sea surface and under the ocean require data, scientific information and knowledge from monitoring (Rayner et al., 2019). Although several challenges exist in acquiring quality scientific information, it is now recognized that evidence-based science for the management and development for marine resources will be the rule, rather than the exception, for sustainability.



The SBEC Science and Research Exhibition grounds at University of Nairobi.

2.3 The Decade of Ocean Science

The very existence of humankind and economic development is intertwined with a healthy ocean ecosystem. It is under this premise that the UN General Assembly, at its 72nd Session proclaimed a Decade of Ocean Science for Sustainable Development, for the period 2021–2030. Furthermore, the UN tasked the IOC–UNESCO to prepare an implementation plan for the Decade in consultation with Member States, specialized agencies, funds, programmes and bodies of the UN, as well as other intergovernmental organizations, NGOs and relevant stakeholders. The UN is uniquely placed to provide a universal framework for science-based ocean action and the Ocean Decade is the only universal UN ocean science initiative.

One key objective of the Decade is to galvanize diverse scientific communities and relevant stakeholders of the ocean to work jointly to expand the current knowledge base on the ocean. The UN is supporting several scientists in assessing current knowledge about physical science on the impact of climate change on oceans and communities that are dependent on it. The information gathered will lead to the unveiling of the Decade in 2021. The UN Decade declaration offers a unique opportunity to transform and co-design the production of knowledge so that it leads to practical and sustainable solutions being developed to address the challenges facing our oceans and helps to build a more climate-resilient planet. Moreover, this UN initiative promotes a common framework for supporting stakeholders in studying and assessing the health of the world's oceans. Steps are already being

taken to raise awareness about the Decade and to facilitate information sharing on this endeavour.


In preparation for the Decade, several IOC Member States are hosting regional preparatory activities and meetings. For example, Kenya has actively engaged in the UN Decade preparations by hosting regional and international consultations, including the SBEC 2018. The culmination of these activities is the UN Ocean Conference in Lisbon, Portugal, which will be co-hosted by Portugal and Kenya.¹³ The Lisbon conference is expected to provide an opportunity to launch the Ocean Decade Alliance, a group of engaged leaders from sciences, academia, culture, governments, private sector, civil society and youth committed to actions through the transformative power of science. Internationally renowned scientists, practitioners and young ocean leaders will share their views with participants on how they can support the Decade. The alliance is expected to further stimulate use of science-based knowledge in addressing challenges facing the oceans. The partnerships and collaborations forged will further support implementation of SDG 14 and related SDGs.

2.4 Inadequate science and threats to sustainability of the ocean

Due to their vastness, complex coastlines and, at times, their remote extents, a lot remains to be learnt about the oceans. The ‘Global ocean science report’ indicates that ocean sciences account for between only 0.04% and 4% of total research and development expenditures worldwide (IOC–UNESCO, 2017). This presents several challenges that need to be addressed for more meaningful economic development. These include climate change and its effects (acidification, sea-level rise and rising sea temperatures), biodiversity loss, pollution, overexploitation, ocean disasters, geohazards, ocean governance and inadequate capacities.

The Intergovernmental Panel on Climate Change’s ‘Special Report on the Ocean and Cryosphere in a Changing Climate’ (2018) paints a gloomy picture. The report reminds us of the likely devastating effects of centuries of GHG emissions on the ocean and the cumulative impacts on societies and the planet. For example, corals in warm waters are almost certain to disappear by 2100, even under the most optimistic scenarios, due to rising ocean temperatures. This depressing state of affairs is exacerbated by the major global disparities that currently exist in capacities to undertake marine research to inform management and development. The ‘First World Ocean Assessment Report’ revealed that the disparity is greater in developing countries and is a consequence of the lack of basic infrastructure and sufficient

¹³ As already stated in Chapter 1, owing to the sudden outbreak of the COVID-19 pandemic, the 2020 Oceans Conference did not take place. It is now scheduled for June–July 2022.



knowledge for sustainable use the oceans (Simcock, 2017). This disparity in capacity threatens the global goal of realizing the full potential of the blue economy. To bridge this knowledge gap, it is critical to put more resources into the development of ocean science to bring states to more equal levels. It will only be through strong scientific research and sufficient ocean monitoring that all regions of the world will be able to deliver a sustainable ocean economy. Further, there is need to nurture a generation of ocean scientists with adequate capacity to respond to the dynamic challenges and demands for the blue economy's development. New partnerships will be instrumental in the acquisition and processing of scientific data and information.

2.5 Priority areas for research

There are several priority areas that need further scientific knowledge to achieve sustainability in the oceans (IOC–UNESCO, 2017). Most of these areas are interconnected, but allow for focused design and planning. However, research and development may need to emphasize a few critical areas to make meaningful progress. The priority areas include:

- mapping the oceans
- establishing an ocean observing system
- understanding ocean ecosystems and functioning
- sharing data and information sharing
- establishing warning systems for ocean hazards and planet observing mechanisms
- building capacity, ocean literacy and technology transfer.

2.5.1 Mapping the oceans

A sustainable blue economy will depend heavily on accurately mapped oceans. This information is important for activities such as shipping and transport, fishing, resource exploitation, and the development of infrastructure and cities along the coast. Further, coastal communities vulnerable to ocean hazards, such as tsunamis and cyclones, depend heavily on high-quality ocean maps.

The current satellite mapping of the oceans is within a resolution of 2–5 km, slightly above 5% (Copley, 2016). The mapping is deficient in ocean depths and important deep-water features. This contrasts with terrestrial surface mapping where most of the conspicuous topographic landscapes are captured. Mapping should not only include depth measurements, but other parameters that cover the biological, physical and chemical environments of oceans. Furthermore, the Decade should incorporate the present efforts championed by the International



Students taking a view of the exhibitions at the university of Nairobi grounds: venue for the Science and Research Symposium

Hydrographic Organization and IOC to map the world oceans. Finally, the ongoing efforts on marine spatial planning (MSP) will put many interdependent maritime activities on a single map.

2.5.2 Establishing an ocean observing system

The ocean economy is currently estimated to amount to about U\$1.5 trillion per year worldwide and was projected to double by 2020¹⁴. The realization of this potential in economic growth was also projected to depend heavily on ocean observations (Rayner et al., 2019). Ocean measurements include understanding weather, climate, and the future state of marine ecosystems and resources. The Global Ocean Observing System (GOOS) that is being used has good capability in the upper 2 km of the water column and the surface, but this leaves much of the deep ocean unexplored. For GOOS to be more effective, it needs to include additional parameters, such as measurements of physical dynamics, biogeochemistry and ecosystems of deep oceans. Although GOOS is a shared undertaking, few nations contribute to the database, which means critical ocean basins that may be useful in understanding the oceans are not included. Many Member States have not been

¹⁴ See, <https://thecommonwealth.org/blue-economy> accessed on 18th September, 2021.

able to contribute due to under-resourcing. For GOOS to collect standard uniform data that can be freely shared, and also to adapt to emerging issues, routine maintenance is essential. The Decade is expected to galvanize international partnerships so that they can comprehensively monitor the major ocean basins and integrate with GOOS.

2.5.3 Understanding ocean ecosystems and functioning

Scientific knowledge on what lived, lives and will live in the oceans has been enhanced recently, especially under the IOC Ocean Biogeographic Information System. The Decade is expected to build on this data to enhance capacity by using emerging technologies, such as environmental DNA sampling to reveal much of what has not been measured or well understood in the past. An array of scientific knowledge is expected to be gained: from microscopic organisms, such as bacteria, to mega-sized mammals. This new form of science will replace older, more laborious ways of conducting analysis. The new science frontier will help scientists to better explore the dynamics of deep oceans ecosystems.

2.5.4 Sharing data and information

Data and information are critically important in the management and development of the ocean economy (OECD, 2019). To better understand the ocean and sustainably utilize its resources, open access to global data is essential. There is a disparity in data and available information across the globe. The provision of an open access and well-preserved data portal for all, will make information available worldwide. Advances in science in one area could then easily be applied in another.

Scientific publications over the Decade are expected to be important, but what will be crucial is the impact that the science content and recommendations will have on meeting human needs. As the Decade progresses, new data and information will be used, which will take the world assessment of oceans to the frontiers of mega data. To achieve the mega-data dream, private–public partnerships will be important as information technology companies could offer the technological support required by science and development. Further, all countries, including less developed states, should be beneficiaries of such data through mechanisms such as the IOC International Ocean Data and Information Exchange Programme.

2.5.5 Establishing warning systems for ocean hazards and planet observing mechanisms

There are several separate warning systems for ocean-related hazards, like tsunami and storm surges, and emerging ones, such as harmful algal blooms. An effective warning system must be generated on a timely basis and must reach

the target at the right time effective action to be undertaken. As outlined in Sendai Framework for Disaster Risk Reduction,¹⁵ warning systems need to be strengthened and harmonized both to reduce risks and enable better planning. This would allow coastal communities to prepare for and respond appropriately to threats. The Decade's emphasis should lead a shift in methodological improvement, which strengthens and scales up preparedness of communities at risk from ocean hazards. This is better achieved by government partnerships and international collaborations. Effective warning systems will be based on improved science on the dynamics of the ocean.

Ocean science is critical in Earth system science, and GOOS as it contributes to the Global Climate Observing System is an integral part of this. Earth system models will be critical in the study of, and in making future predications regarding, the state of the oceans. To further understand the dynamics of the planet, societal changes and ocean economy, expansion will be included in the modelling. Thus, ocean science will form a strong component of the emerging parameters in modelling the planet.


There is now interdependence between activities along the coastal zones and operations in the ocean that could require prompt decision-making for action to be taken. This capacity, especially in ocean modelling and prediction, is lacking, and the Decade will need to coordinate modellers to align them with the multiple stakeholders involved in ocean observations. There is huge potential in oceanographic observation and modelling capacity to help humans sustainably harness the blue economy.

Community science studies, such as ethical ocean stewardship and economic evaluation of oceans, are still inadequate. Quantitative assessments of the tangible and intangible benefits related to oceans may advocate for the reduction of land-based pollution, thus benefiting the ocean economy, while also protecting untapped underwater resources and cultural heritage.

2.5.6 Building capacity, training, education and technology

Ocean science capacity building is of paramount importance to progress with the state-of-the-art research and development envisioned. This is critical in the dissemination and guiding of sustainable development. The most enabling capacity progress will be in areas of human capacity and infrastructure. The IOC, in the 'Global Ocean Science Report' (2017) showed that oceanographic capacities are uneven worldwide, limiting contributions to science and the benefits accrued from

¹⁵ For the full text of the Sendai Framework for Disaster Risk Reduction, see <https://www.undrr.org/implementing-sendai-framework/what-sendai-framework>.



scientific and technological knowledge. One goal of the Decade is to strengthen the existing capacities, and enhance training and education, with the aim of transferring marine technology. The Decade is expected to develop principles of ocean literacy, especially on the role of people and the planet. Vigorous campaigns and ocean literacy programmes need to be designed with target groups, such as school students, decision-makers, governments, civil societies and the general public, in mind. Gender mainstreaming should be a key priority, especially considering women represent an average of 38% of marine scientists.

2.6 Technology and innovation for the blue economy

The oceans are expected to be one of the many challenges that the globe faces in the coming decades. It is expected that by 2050, there will be 9–10 billion people on Earth (OECD, 2019), with a quarter of the population living in Africa. This prompted the development of the 2050 Africa Integrated Maritime Strategy (AU, 2012). Six of the world's ten fastest-growing economies will be from Africa (IMF, 2014). The oceans and their resources will play a critical role in meeting the requirements for this rapid population growth and expansion of the global economy. Achieving the sustainable utilization of the oceans to meet the needs of humankind will not be easy: the ocean's health is already under intense stress from overexploitation, pollution, ocean acidification, rising sea levels, diversity loss and climate change. All these factors have adverse socioeconomic consequences for humanity.

To safeguard and expand the benefits accrued from the oceans, innovation in science and technology will be of considerable importance. Improved transfer and sharing of technology and innovations will be essential for countries to equally contribute (OECD, 2019). Many communities, especially those in some developing countries, are dependent on marine resources for their daily livelihoods. Adverse effects on the ocean and its resources have severe ramifications on their wellbeing. To sustain the flow of benefits from aquatic systems and enhance human and ecosystem wellbeing, innovative thinking is needed (UNECA, 2016). To succeed, we need fresh ways of thinking and doing things to address the current and emerging challenges and to fully realize a sustainable blue economy. For example, old laboratory analysis procedures could be replaced with new emerging technologies that are more capable of quality data collection and analyses (OECD, 2019). This includes innovations such as environmental DNA sampling to reveal much that has previously not been measured or particularly well understood. Such technologies generate an array of scientific knowledge from microscopic to macro-organisms. Remote sensing applications with high frequency and resolution can be applied in areas such as monitoring and modelling of oil spills from ships, water chemical contaminants,



A cross section of participants at the SBEC Science and Research symposium, University of Nairobi.

fishing activities and biochemical modelling of algal biomass. These measures will lead to a better understanding of ocean stressors and help explain the carrying capacity of the ocean to support human disturbance and economic development for the blue economy. Other areas include strands of sciences, such as physics and biochemistry. Technological advancements will range from artificial intelligence and big data to robotics.

2.6.1 Opportunities for technology and innovation

To succeed in the sustainable utilization of aquatic ecosystems, development on both scientific innovation and technological fronts will be needed. The innovation and technology adopted should ensure a win-win situation and benefit economic development and environmental sustainability (OECD, 2019). To this end, several already available technologies and innovations will be useful. These innovations can be found in the scientific areas of green energy, reduction of carbon footprints, MSP, mariculture, marine species alien invasion, emerging technologies and multifaceted approaches, to mention but a few.

2.7 Green energy

States are moving away from high cost and environmentally polluting carbon-based sources of energy, such as coal, to hydropower and ocean energy. These green energy innovations include floating wind energy. The International Energy Agency estimates that energy from the ocean output potential is equivalent to 100–400% of current global energy (IEA, 2012). For example, countries like Cape Verde are now using energy from waves to light up remote and isolated areas. The immediate challenges of realizing the full potential of such energy are its initial high investment costs and policy issues. However, evolving innovations are bound to lower costs and the benefits are expected to flow into other maritime economic sectors, such as ports, the construction and repair of shipyards, and shipping. Science and technology will be critical in addressing the engineering and financial challenges and closing knowledge gaps.


2.7.1 Reduction of carbon footprints

Recently, countries have increased their efforts to protect marine and coastal ecosystems as part of their climate change adaptation strategies. This has been followed closely by the United Nations Framework Convention on Climate Change's (UNFCCC) development of strategies to enhance terrestrial and marine carbon sinks that include blue forest and blue carbon concepts. These entail storing and sequestration of blue carbon in blue forest habitats, such as mangrove forests, seagrass meadows, intertidal salt marshes, and kelp forests and beds.

Blue forests found along marine and coastal ecosystems provide multiple ecosystem services. The forests protect communities from coastal erosion, storms, and flooding, making them vital for climate change adaptation. An example of a blue carbon project is the Mikoko Pamoja (literarily translated to 'mangroves together') in Kenya. The project works towards the rehabilitation, protection and sustainable use of mangroves, leading to the generation of an estimated 3,000 tonnes in CO₂ equivalent of carbon credits. The carbon stored in mangroves is sold to voluntary carbon markets and generates about US\$12,000 per year. This is used by local communities to improve their wellbeing through the expansion of basic education and provision of clean water.¹⁶ Further, planted mangrove forests are now used for ecotourism. The project, verified under the Plan Vivo Foundation standard, is expected to enhance the sustainable utilization of mangroves ecosystems and improve the coastal ecosystem.

The Conference of Parties under the UNFCCC umbrella has also developed other initiatives, such as the Green Climate Fund, through which countries can address

16 For the Mikoko Pamoja and accruing benefits, see Mwangi and Evans (2018).



their development priorities in relation to climate change. The benefits accrued from such strategies could be used in the production of green energy from the blue environment. Additionally, blue carbon markets could provide countries with the much-needed economic incentives to manage resources sustainably and to restore their coastal and marine ecosystems.

2.7.2 Marine spatial planning

Many countries can use MSP as a tool to develop their blue economy. MSP is a participatory process that brings together several ocean users – including those working in fisheries, conservation, recreation, energy, governments, and oil and gas – to understand how to use marine resources sustainably. This integrative and adaptive process informs coordinated decisions that will reduce conflict in marine resource space usage, contributing enormously to their sustainable use. This structure will achieve better ecological, economic and social goals that are essential for a sustainable blue economy.

2.7.3 Mariculture research and ecosystem management

Demand for fisheries and their products is increasing, while production is rapidly declining (mostly due overexploitation). Aquaculture production is expected to bridge the gap. However, the sector has many challenges, including diseases that account for up to 40% of production losses (Gomes et al., 2017). Diseases have proven costly, rendering the industry almost insolvent. One solution is through scientific and technological innovation. This includes technology for early forecasting for action, such as early or delayed harvest of shellfish; reducing cage stocking density; breeding varieties with greater resistance; and using genomic science.

Other technological advances include sensor platforms to detect uneaten food, algorithms to decide which fish have enough feed, automated feeding techniques, computer vision techniques, acoustic telemetry, spatial mathematical modelling combined with remote sensing, and artificial intelligence (Føre et al., 2018). To make fisheries and aquacultural development sustainable, science-based management of ecosystems with enhanced monitoring that is precise and predictive is essential.

2.7.4 Invasive alien marine species

Invasive alien marine species are an issue across the globe. The invading species disrupt and damage local species and ecosystems. The spread of alien species has mainly been through sea-going ships. Globalization and a rapid rise in maritime transport has increased the spread of invasive alien species across the oceans.

The main route for redistribution of marine species globally is through ship hulls (biofouling) and ballast water. Innovation in ballast water treatment and the use of antifouling paints can reduce the redistribution of such alien species.

2.8 The need for a multifaceted approach

A multifaceted understanding of the ocean that involves many scientific disciplines, ranging from biology to physical sciences, could help solve some of challenges facing the sustainable utilization of blue spaces (OECD, 2019). Building and analysing long time series data, collecting new data and adopting new technologies will also go a long way in helping to create the knowledge and information required to manage and develop the ocean economy. Moreover, due to organizational structures and different ocean science capabilities across the globe, international cooperation will be essential for success (IOC–UNESCO, 2017). A concerted effort is needed to improve international and interdisciplinary scientific collaborations coupled with technological and innovation transfers to bridge knowledge gaps. A holistic approach to managing threats to aquatic ecosystems is bound to yield a greater level of success. For example, most pollution of aquatic systems is from land-based sources, through domestic and commercial wastewater and agricultural runoff. Alternatives that are more eco-friendly are needed, especially those that minimize waste through use of the circular economy (OECD, 2018). Technological innovation directed to sustainable petrochemical production and use will reduce the effects of harmful chemical pollution that finds its way into the ocean.

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Chapter 3

The Sustainable Use of Mineral and Energy Resources of the Blue Economy


3.1 Context and background

It is increasingly necessary to focus on the resources of the blue economy. One of the most pressing reasons is the dwindling amount of land resources. Oceans alone cover almost three-quarters of the Earth's surface and are home to more than half of all life forms, as well as vital non-living resources. This presents both challenges and opportunities for global sustainability. The main challenge is that this vastness of the Earth's water resources has created a false impression that they are limitless. In some cases, this has led to massive overexploitation and degradation. Nevertheless, there is a real opportunity to tap into this massive resource in developing countries and contribute to the globally adopted SDGs and the 2030 Agenda for Sustainable Development.

For developing countries, the question is no longer whether the use of resources within the blue economy is the way forward, but whether governments can raise the necessary funding to create the infrastructure necessary to sustainably harness the resources. A further issue is whether the funding promised by developed countries will be made available.

This chapter seeks to assess the potential contribution of blue economy resources to developing countries' sustainable development from the perspective of marine mineral resources.

Future discussions on this issue should be based on devising both technological and policy solutions for the sustainable and inclusive development of marine mineral resources (the non-living resources of the continental shelf). These remain largely unexploited but have significant implications for the sustainable development of developing countries. However, new opportunities for uses of marine and inland water resources come with challenges, especially if long-term sustainability is not factored into the development and implementation of new technologies. In particular, it is imperative, but also difficult, to minimize the risks surrounding such



development. These include the depletion of resources and degradation of ecosystems through overfishing or destruction of habitat, pollution (such as eutrophication, industrial wastes, endocrine disrupters and oil spills) and invasive species that can compromise industrial cooling systems, overtake ecosystems or interfere with aquaculture through toxicity or reduction of yields. At the same time, this should be considered in the context of other non-anthropogenic impacts, such as coastal erosion exacerbated by storm surge, and the hazards of wind, waves, currents and ice in the broad range of extreme environments where marine operations are conducted. Global change complicates risk management and environmental stewardship. The economic use of marine resources is expanding rapidly, while the ocean and its ecosystems are changing, due to natural variability that is increasingly influenced by human activities at local, regional and global scales.

The sustainable use of blue economy resources will require strong links with the SDGs (in particular, SDG 6, SDG 12, SDG 12.2 and SDG 2.3), research and technology, provision of enabling policies, legal frameworks and institutional strengthening, as well as targeted capacity building. Further, it is important to look at all available resources, including mineral resources, hydrocarbons (oil), marine gas hydrate deposits, offshore wind energy and tidal energy, marine polymetallic sulfides, marine manganese nodules and manganese crusts/cobalt-rich crusts.

3.2 Problem statement

To realize the sustainable development benefits associated with exploitation of marine resources, there are several important challenges that low-income economies, particularly African economies must overcome. First, there needs to be an interface between science, research and policy formulation that promotes knowledge and evidence-based decision-making and investments in the sustainable development of the blue economy. Key issues that need to be addressed include:

- development of adequate capacity (human skills and technology) that enables the energy and mineral resources within the blue economy to be harnessed sustainably;
- creation of opportunities under the blue economy packaged in a bankable way so that these can attract potential investors in innovative and affordable financing for the sector;
- policy formulation and regulatory frameworks to promote sustainable energy and mineral resources industries within the blue economy sector;
- allocation of greater financial resources to research, development and effective policymaking in harnessing the blue economy.

3.3 Policy and technological solutions

The conundrum with sustainability is that we live in a world of complex, interconnected challenges, where an action that addresses a particular sustainable development challenge could potentially present a separate challenge of its own. There are concerns, for instance, that commercial exploration for marine minerals is rushing ahead of the research effort needed to support effective management of the oceans. This could, in particular, negate the attainment of the oceans-related SDGs, such as SDG 14.1 (prevention of marine pollution); SDG 14.2 (sustainable management and protection of marine and coastal ecosystems), SDG 14.5 (conservation of at least 10% of coastal and marine areas) and SDG 14.a (increasing scientific knowledge, develop research capacity and transfer marine technology, taking into account the IOC Criteria and Guidelines on the Transfer of Marine Technology). Without addressing these concerns and despite the sustainable development benefits highlighted above, exploitation of marine mineral resources could come at a great cost to the overall sustainability agenda. The right balance therefore needs to be struck – one that ensures that the oceans-related SDGs are attained by the use of resources that are themselves sustainably exploited. From some of the presentations, it emerged that challenges to policy and technological solutions are inevitable.

3.3.1 Impacts on existing interests

The influence of the exploitation of marine mineral and energy resources on existing uses and interests (e.g. fisheries, marine mammals, marine protected areas) is very important. This influence includes sediment movement, ecotoxicological effects, ecosystem responses, economic trade-offs and uncertainty in decision-making. Regulators should undertake MSP to identify locations and priorities for all users of the ocean environment. Blue economy ecosystems are increasingly being affected by anthropogenic stressors, such as pollution, overfishing and increasing frequency of extreme weather and global warming events. This leads to the degradation of many ecosystems. Consequently, it is important to understand the vulnerability of the resources and the extent to which management actions can build ecosystem resilience and maintain ecosystem service provision. There is a critical need for updated information on the status of these resources, including coral reefs and the extent of the mass coral bleaching we are currently witnessing.

There is a complex set of interactions, at multiple levels, between the natural, social and governing systems. To address the challenge of reconciling human use of the oceans and global change, we need to develop an understanding of these interactions, their key drivers, impacts and responses. Approaches must necessarily be inter- and transdisciplinary, from local to global, and at multiple scales. However, there are still major disconnects between the natural and social

sciences, science and policy, and public perception of global change (including its causes and the ‘reality’ of change). Our challenge is to address these disconnects and develop approaches to account for and integrate both humans and nature into ocean science, management and governance to provide the opportunities offered by blue growth.

3.3.2 A precautionary approach: balancing uncertainty and adaptive management

Balancing uncertainty with the need to make decisions in a poorly understood ocean environment is a massive challenge. Limited availability of baseline information has led to a reliance on modelling, with great uncertainty about current state, or environmental impacts of future mining. A truly adaptive approach is nearly impossible, given that the capital investment required to begin the mining process requires certainty for investors.

3.3.3 Newness and understanding impacts

It is vital that we provide for ‘newness’ in emerging technologies and practices, such as deep-sea mining, in the blue economy. The fact that an activity is new might be positive, with economic benefits that outweigh environmental costs. Having adverse effects is acceptable; but understanding, communicating and managing them is key, alongside balancing the impacts on other uses.

3.4 Marine mineral resources and the blue economy

The blue economy has progressively evolved to encompass the sustainable use of all surface water resources; that is, oceans, seas, lakes, rivers, wetlands and other water resources. The vastness of the Earth’s water resources has created a false impression that they are limitless, leading to their massive overexploitation and degradation (UNEP, 2015). In this regard, the blue economy, as a growing global concept in sustainability, is opportune as it seeks to reverse this decades’ long degradation and overexploitation of the Earth’s water resources, in addition to bringing to the fore the importance of water resources to the global economy.

Among other opportunities, the blue economy can contribute to the SDGs,¹⁷ particularly those on water (SDG 6) and sustainable resource use (SDG 12). These include SDG 6.3 (water quality), SDG 6.4 (water use efficiency), SDG 6.5 (integrated management of water resources), SDG 6.6 (protection and restoration of water related ecosystems), SDG 6.a (international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes) and SDG 6.b

¹⁷ For the references herein to the globally adopted, SDGs and associated indicators and targets, see: <https://unstats.un.org/sdgs/metadata/>

(local communities' participation in water and sanitation management). Other goals of relevance are SDG 14.1 (reduction of marine pollution), SDG 14.2 (sustainable management and protection of coastal ecosystems), SDG 14.3 (minimization of the impact of ocean acidification), SDG 14.4 (effective regulation of fish harvesting), SDG 14.b (provision of access for small-scale artisanal fishers to marine resources and markets), SDG 14.c (conservation and sustainable use of oceans and their resources through implementation of relevant international laws) and SDG 12.2 (sustainable management and efficient use of natural resources).



The blue economy can enable developing countries to achieve some of their development goals, while contributing to global sustainability within the context of the above SDGs. This could be done by exploiting mineral resources, which generally remains an overlooked area in global sustainability discourse (both in terms of their contribution to sustainability and how they can be sustainably utilized). However, the oceans are associated with a lot more resources that hold great prospects for developing countries' sustainable development. These include energy resources, such as hydrocarbon (oil) deposits, marine gas hydrate deposits, offshore wind energy and wave energy (a nascent technology that is still under development). They further include deep-sea mineral resources that comprise marine polymetallic sulfides, marine manganese nodules and manganese crusts/cobalt-rich crusts (Murton, 2000). Sustainable exploitation of continental mineral resources can address some of the contemporary sustainability challenges. For instance, marine phosphorites (discussed in Section 3.4.4 as a case study) could be an additional source of phosphorus in the face of the depleted land deposits, a scenario that threatens global food production and food security (Cordell, 2010). This chapter addresses the sustainability of submarine mineral resources from two perspectives: (i) the sustainable development benefits associated with their exploitation and (ii) the policy, technological and research solutions needed to ensure that the exploitation is ecologically sound and socially equitable.

3.5 Continental shelf mineral resources

Non-living resources of the deep ocean floor are increasingly being turned to as alternatives to the rapidly depleting continental resources. Many of these resources are found on the continental shelf and its extensions and, therefore, give the adjacent coastal state the potential to control their exploitation (Murton,

2000). The resources of interest here include phosphorites, marine placer deposits, aggregates and evaporites.

3.5.1 Marine placer deposits

Placer deposits are concentrations of detrital heavy metallic minerals that have become separated from their normal assemblage of lighter minerals. They are formed in high-energy environments such as the surf-zones along beaches. As a result of their high specific density (which limits their movement), placer minerals are generally confined to locations within a few tens of kilometres from their source rocks. Further, the relationship between sea-level changes and the formation and preservation of placer deposits puts limits on their occurrence offshore: a lowering of sea level exposes the minerals for exploitation, while a rise in sea level buries them.

Consequently, subsequent rises in sea level following the last glacial maximum (18,000 years ago) when the sea level was lowered by approximately 120 m resulted in the burying of many of these deposits by sediment transgression. Due to these two factors (Pleistocene sea-level changes and their high specific densities), marine placer deposits are generally confined to locations within a few tens of kilometres from their source rocks (Murton, 2000). The most economically important of these minerals (and their associated elements) are cassiterite (tin), ilmenite (titanium), rutile (titanium), zircon (zirconium), chromite (chromium), monazite (thorium), magnetite (iron), gold and diamonds (Harben and Bates, 1990). Diamonds have been extracted from the coast of South Africa and Namibia for a long time, and deposits of tin, titanium and gold have been extracted along the coasts of Africa, Asia and Australia. Titanium has been mined from placer-derived deposits from beach sand in south-east and south-west Australia, in east South Africa, south India, Mozambique, Senegal, Brazil and Florida, USA. The iron–titanium-rich placer mineral magnetite has been mined in large quantities from the north-western coast of New Zealand (North Island), Indonesia (Java), the Philippines (Luzon) and Japan (Hokkaido). Cassiterite, occurring in fluvial placers, is recovered from nearshore and offshore sediments in the ‘tin valleys’ of the Indonesian Sunda shelf (extending from the islands of Bangka, Belitung and Kundur), Malaysia and Thailand, where about a third of the world’s current production is derived. Lastly, the majority of presently recovered gold is derived from fluvial placer deposits, although it sometimes occurs in beach placers (e.g. in New Zealand and Alaska) (Murton, 2000).

3.5.2 Aggregates

Aggregates are deposits of sands, gravels or shells that are used mainly in the construction industry, such as for concrete and cement manufacture. They occur both on beaches and in offshore areas, where they have been concentrated by normal

hydrodynamic processes (Odada, 2001). Offshore and beach sands generally consist of stable minerals, such as quartz. However, non-quartz sands are common in tropical areas, especially on beaches behind coral reefs. Mixed sand containing quartz, feldspar and other minerals occurs in some areas where the source rock is polymineralic. Offshore and beach gravels also consist generally of fragments of stable rocks such as quartzite, flint and chert, which do not break down easily on transportation. Lastly, offshore calcareous sediments (shells), which are mainly used in the manufacture of cement and lime, are deposits formed by the breakup of marine shells and their concentration by hydrodynamic processes. They occur both on beaches and in shell banks, formed from transport of broken up shells on the sea floor (Odada, 2001).

Quantitatively, sands, gravels and shells are the most important offshore mineral deposits being extracted at the present time, other than oil (Odada, 2001). For this reason, the sustainability of this resource has lately come into sharp focus, with emerging concerns that its overexploitation, and sometimes illegal mining (because of the growing demand, especially since 2000), is damaging the environment, endangering communities, causing shortages and promoting violent conflict (Torres et al., 2017).

3.5.3 Evaporites

Submarine evaporites are formed by evaporation of sea water and other natural brines in geologic basins of restricted circulation. They are composed mainly of anhydrite and gypsum (calcium sulfates), sodium and magnesium salts, and potash-bearing minerals. Elemental sulfur, although not strictly an evaporite, forms in association with some deposits by biogenic alteration of anhydrite (Murton, 2000).

Evaporite deposits formed in ancient marine basins are extensive on land. Many of them also extend beneath the sea (under the continental shelves and some marginal ocean basins). Examples include the Sigsbee Deep salt domes in the Gulf of Mexico, the Canadian Arctic (including Hudson Bay), the north-west African shelf, the Mediterranean Sea, the north-eastern margin of Brazil, the Grand Banks of Newfoundland, parts of the eastern African margin and western Australia. Because of their widespread occurrence on land, and the ease of obtaining salt by evaporation from seawater in many coastal regions, these minerals are already widely available, and therefore there is little value in exploring their marine deposits, except perhaps in areas that are far removed from the conventional supplies (Murton, 2000).

3.5.4 Phosphorites

Submarine phosphorites generally occur in water depths of less than 100 m on continental shelves, offshore banks and plateaus in the form of nodules, pellets



and oolites, fish debris and shells (Murton, 2000). Pellets and nodules are the most common forms in shallow marine environments (Odada, 2001). They are most abundant on the western margins of the continents, but also occur off some eastern continental margins.

The main phosphorite occurrence areas are those of upwelling off western continental margins, the upwelling is caused by oceanic circulation patterns that further give rise to divergence. This upwelling brings to the surface cold nutrient-rich water, which support high biological activity – mostly diatoms – in the surface waters. The high biological activity supports large bird populations. When they die, these organisms sink and decay, a process which plays a large part in the formation of submarine phosphorites (Odada, 2001).

In addition to continental margins, oceanic seamounts (many of which were islands in the past), islands and atolls are other important environments for marine phosphorite formation.

To date, marine phosphorites have not been as extensively exploited as land deposits. However, changing circumstances, with potential depletion of known land reserves in the near future, could necessitate offshore phosphorite exploration and production to ensure a continuing supply of phosphorus, particularly for fertilizer production. Further, for developing countries, it might be more economical to mine offshore phosphate than use valuable foreign exchange to import the same, particularly in the context of phosphate price inflation or deliberate price setting and hikes by suppliers with a large market share (Odada, 2001).

3.6 Submarine mineral resources: policy and technological solutions for sustainable utilization

As earlier stated, the biggest obstacle with sustainability is the interconnected nature of problems where an action that addresses a particular sustainable development challenge could potentially present a sustainable development challenge of its own (Holland and Wielgus, 2013).

Without addressing the concerns identified and despite the sustainable development benefits of exploitation of marine mineral resources, such as phosphorites, could come at a great cost to the overall sustainability agenda. The right balance therefore needs to be struck to ensure the goals of all SDGs are attained through the use of resources that are themselves sustainably exploited. To realize this with respect to marine mineral resources, various policy and technological solutions have been proposed which are elaborated below.

3.6.1 Research and development

Research and development will be indispensable to the sustainable utilization of marine mineral resources. Research and development are needed to provide data and information on the availability, location, quantity and nature of the minerals. At present, knowledge of what lies beneath the continental shelf, even just a few kilometres offshore, is flimsy at best, and is mostly informed by geological intuition. Research is also needed to understand the potential environmental impacts of continental shelf mining and deep-sea mining, as well as mitigation measures that could be undertaken. These impacts could include killing/crushing of living organisms, removal of substrate habitat and disturbance of sediments, creation of sediment plumes that could bury seafloor organisms or clog the siphons of filter-feeding organisms, environmental damage from potential malfunctions of the mining equipment, and pollution from the onshore processing of the recovered minerals.

3.6.2 Capacity development

Every action and initiative needed to bring about sustainable exploitation of marine mineral resources depends on capacity development. This includes capacity in, but not limited to, research and development. Other capacity-building areas may include legally backed and adequately resourced institutions (including research centres), equipment for research and exploration, personnel (marine scientists and ocean governance specialists) and other critical areas that will be identified as crucial for sustainable development of ocean resources. The Prospects for Sustainable Development of the African Maritime Domain in Support of the Blue Economy event, held on 2–4 May 2017, recommended the establishment of multidisciplinary centres of excellence on research and development of marine mineral resources, traineeships and scholarship schemes. It further advised the incorporation into formal educational curricula of education, knowledge building, and capacity building in deep seabed mining. The primary role of the African Centres of Excellence in marine research and development (to be selected and built from existing regional institutions) will be to provide increased access to marine geoscientific information and high-quality marine research, education and training (ISA, 2017).

3.6.3 Policy and legislation

Similarly, an appropriate regulatory framework, that includes necessary conducive policy and legal instruments, will be required at national/state and regional levels to support the sustainable exploitation of marine mineral resources. The International Seabed Authority has been working on such a regulatory regime, which may be of use to coastal states and regional trade blocs interested in exploiting their marine mineral resources. This framework includes operational guidelines for the application of the

precautionary approach, compliance and monitoring measures. It provides guidelines for the establishment of marine protected areas, risk assessment methodologies, mechanisms to address risks and the application of best environmental practice. Further, it gives guidelines for an effective, efficient, transparent and flexible system for equitable sharing of benefits arising from the exploitation of mineral resources (Global Ocean Commission, 2013). The latter is particularly important for developing countries, given that they often do not have the technology and capital needed to carry out seabed mining for themselves, a limitation that is also recognized by the United Nations Convention of the Law of the Sea (UNCLOS).


3.6.4 Knowledge and technology transfer

There have been several technological and knowledge advances in marine mineral exploration, mining and processing over the last four decades. These strides occurred after the initial 1970s euphoria died down as a result of the collapse in world metal prices, combined with relatively easy access to minerals in the developing world (Global Ocean Commission, 2013). Some of the technologies that have emerged include underwater mapping and bathymetry systems, reflection and refraction seismology, magnetic detection technology, optical imaging, remotely operated vehicles, submersible vehicles, deep salvage technology, active and passive military acoustic systems, classified bathymetric and geophysical data, and undersea robots and manipulators. Most developing countries lack the capacity to develop most, if not all, of these technologies. Knowledge and technology transfer to developing countries is therefore inevitable for sustainable exploitation of marine mineral resources. Technology transfer must, however, occur within the IOC Criteria and Guidelines on the Transfer of Marine Technology (IOC–UNESCO, 2005).

The approach recommended by the emerging network of players in the marine mineral resources sector of the continent is the formation of collaborative body among African states using the Pacific countries as a model of cooperation. The partnership can be organized regionally and embody collective action among its members regarding seabed mining operations. This can also be utilized to sponsor contractors to engage in seabed exploration activities in reserved areas (ISA, 2017). The body could also forge North–South and South–South collaborations on knowledge and technology transfer.

3.7 Conclusions and recommendations

Sustainable exploitation of Africa’s continental shelf marine mineral resources holds great prospects for the continent’s sustainable development. Nearly every type of metal in demand today is accessible in mines close to the sea, with more than 1,700 ore deposits located less than 50 km from the ocean. A case study of phosphorus in



agriculture demonstrates how sustainable exploitation of marine mineral resources could help address food and nutrition security challenges and contribute to the SDGs. Improving agricultural productivity and production are themselves SDG targets. SDG 2.3 seeks to double agricultural productivity and incomes of small-scale food producers, particularly women, indigenous peoples, family farmers, pastoralists and fishers by several means, including increased use of agricultural input such as fertilizers. This is linked directly and indirectly to other SDG targets, not least those under SDG 2 on ending hunger. These include SDG 2.1 (ending hunger and ensuring access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round) and SDG 2.2 (end all forms of malnutrition).

This action is also directly linked to SDG 1.1 (eradicating extreme poverty for all people everywhere) given the pertinent contribution of agriculture to incomes of small-scale food producers, especially women, in rural Africa, and SDG 3 (ensuring healthy lives and promote wellbeing for all at all ages) for the linkages between good health and nutrition. It is also indirectly linked to SDG 9.2 (raising industry's share of employment and GDP) given the large share of agro-processing in the continent's manufacturing sector. For African and other developing world states, their limited technical and financial capacity means focusing on the continental shelf mineral resources in the short term makes economic sense. Mining could be performed in a more economically feasible and environmentally friendly way compared to deep-sea mining – by means of tunnels from land or from artificial islands or platforms. In addition, there are fewer legal issues to deal with since the deposits in coastal regions are already within declared EEZs (as defined under UNCLOS).

The potential policy and technological interventions required to sustainably harness these resources and to ensure that the exploitation does not negate the attainment of the ocean-related SDGs include:

- research and development particularly on resource mapping and understanding the environmental and ecological risks of deep-sea mining, and a conducive regulatory regime (with elements such as operational guidelines for the application of the precautionary approach);
- compliance and monitoring measures;
- guidelines for the establishment of marine protected areas;
- risk assessment methodologies;
- mechanisms to address risks and the application of best environmental practice;

- guidelines for an effective, efficient, transparent and flexible system for equitable sharing of benefits arising from the exploitation of mineral resources);
- capacity development including the establishment of African Centres of Excellence in marine research (to provide African states with increased access to marine geoscientific information and high-quality marine research, education and training);
- finance; and,
- knowledge and technology transfer through both North–South and South–South collaborative mechanisms.

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Chapter 4

Climate Action, Pollution and the Building of Sustainable Resilience

4.1 Climate change, pollution and the resilience agenda at SBEC 2018

The SBEC 2018 framed discussions around climate action and resilience in order to illustrate the dangerous consequences of climate change and environmental pollution on the blue economy. The blue economy, which, as we have noted, encompasses oceans and other inland water surfaces,¹⁸ provides invaluable ecosystem services that support the livelihoods of billions of people around the world. Due to increased anthropogenic activities, coupled with the impacts of climate change, there has been additional pressure placed on the world's aquatic ecosystems to the extent that their very health and wellbeing has been undermined. To counter some of these impacts, the SBEC Science and Research Symposium provided an opportunity for researchers and key academic stakeholders to share ideas that could offset help the current economic and environmental challenges. The blue economy provides a strong basis for improved human well-being and social equity, and is a major contributor in addressing environmental risks and degradation:

Climate change and environmental degradation are a threat to the integrity and sustainability of aquatic ecosystems, coastal communities, marine resources, port infrastructure, tourism and recreational facilities, among others, on which the blue economy is based. Protecting aquatic ecosystems and coastal regions through sustainable blue economy initiatives, can help mitigate these pressures and increase resilience. (SBEC, 2018).

In general, climate change has a variety of well-documented impacts across ecosystems. For oceans, the impacts are mainly through warming, melting of the polar ice, rising sea levels, changes to the ocean's major current systems and ocean acidification. The elevated temperatures affect biological diversity, including coral bleaching, forced migration of many species, interference with life cycles of marine species, and the availability of nutrients to many important marine ecosystems. The

18 The definition of blue economy will, for the time being, remain tenuous as it has depended on what various countries and institutions want to emphasize.

rise in sea levels has endangered the survival of coral reefs, mangroves, sea grasses and other critical habitat-forming species, as well as nesting beaches for marine life. Moreover, when ocean acidification increases, as a result of absorbing carbon dioxide, (CO₂), many ocean plants and animals are directly harmed or killed due to their sensitivity to acidic conditions in the aquatic ecosystem.¹⁹ The Small Island States (SIDS) who have globally pushed for the recognition of the sanctity of blue economies and the specific use of this particular term, remain directly threatened by rising sea levels. Some, such as Kiribati citizens, are already among the world's first refugees of sea-level rise, and two of the nation's islands have already disappeared into the ocean.²⁰

4.1.1 On the challenge of ocean pollution and marine litter

The SBEC 2018 framing concept further recognized that ocean pollution is manifested in terms of nutrient over-enrichment and marine litter (plastics, chemical and oil pollution), as well as pollution from ships.²¹ Moreover, underwater noise has negative impacts on marine ecosystems. However, of critical concern are the non-biodegradables, persistent pollutants and GHG emissions from ships.

Nutrient pollution mainly occurs from inefficient wastewater treatment plants, agricultural and urban runoff, polluted groundwater seepage, atmospheric deposition and the release of previously accumulated nutrients from sediments. This cumulative release of pollutants from point and non-point sources greatly affects the growth of the blue economy, while non-sustainable agricultural activities along the water bodies specifically increased pollution in freshwater bodies, seas and oceans (SBEC, 2018: 21–22).

Discussions at SBEC 2018, particularly during the Science and Research Symposium, were framed around the underlying effects of pollution on oceans. These are clearly monumental and pose serious sustainability challenges. Scientists have long recognized that

pollution also led to the depletion of oxygen content in the water; toxicity of the marine environment, contamination of food chains, hazards to human and aquatic health, hindrances to marine activities, disruption to reproductive systems and life cycles of coral reefs, and the impairment of quality for use of water and reduction of amenities. (SBEC, 2018: 21)²²

19 There are numerous scientific studies that have confirmed the impact of ocean acidification on marine ecosystems. See, among others, Doney et al. (2020) and <https://coastadapt.com.au/ocean-acidification-and-its-effects>.

20 For how SBEC 2018 framed this segment, see SBEC (2018). The Kiribati referred here is, the Republic of Kiribati, an island in the Pacific Ocean.

21 For this and more, see SBEC (2018)

22 For scientific studies on the impact of pollution, see among others, Reisser et al. (2013) and Thiel et al. (2018).


Further, large algal blooms lead to very low levels of oxygen in the water, which subsequently kills fish, shellfish and aquatic plants.

Marine litter in oceans is a major source of pollution with the annual discharge of plastics into the ocean estimated to be 11 million tonnes. One research team recognized fairly early, that microplastics ‘have the potential to affect organisms ranging from megafauna to small fish and zooplankton’ (Reisseret al., 2013). Moreover, over 10% of the total ocean contamination has also been caused by lost or discarded fishing gear which results in the entanglement and deaths of marine mammals and other aquatic organisms (UNEP, 2021). Some recent estimates in fact showed that under business-as-usual conditions, by 2040 municipal solid plastic waste would double, while plastic leakage nearly triple and plastic stock in the ocean would quadruple. The conference was held against a background in which scientific modelling indicated that government and industry commitments would only have reduced marine plastics litter by 7% in 2040 compared to the business-as-usual scenario.

4.1.2 In search of proper management and sustainable protection against pollution

SBEC 2018 highlighted the urgent need to institute proper management of aquifers, rivers and lake basins through, *inter alia*, an ‘integrated water resources management’ (IWM) approach. The IWM approach aims to uphold the integrity of the aquatic environment and its economic sustainability. It includes:

- implementation of basin plans;
- spatial planning;
- use of various new technologies;
- compliance and adherence to requisite legal frameworks;
- employment of best practices on waste management and flood management strategies;
- instituting the practice of ‘marine protected areas’;
- building and promoting climate-resilient communities;
- undertaking capacity building and awareness campaigns;
- involving all stakeholders and users, and establishing feedback systems;
- improving and implementing ‘flag state’ measures;
- instituting ‘port state’ control measures; and,
- more robust international cooperation on transboundary issues.



While it is beyond the scope of this publication to examine these in detail, some are discussed in separate sections. In addition, SBEC 2018 recognized that the risks associated with nuclear pollution must be managed to assure the sustainability of oceans and other water bodies. In this respect, pollution sources and their conduits require mapping and holistic strategies to be developed and implemented to address them.

The GHGs emissions from the shipping industry also need to be monitored alongside weather and water quality, maritime forecasts and sea data observations. These will guide policy decisions on achieving pollution-free oceans. The capacity to detect and respond to oil spills and other disasters that lead to ocean pollution need to be improved, with the obvious trade-off that this also reduces ocean pollution. When the ocean pollution is reduced, the blue economy is enhanced and sustained with a corresponding reduction of pressure on land-based livelihoods, which in turn means the lessening of land-based pollution.

Conclusively, the prospects for effective and sustainable climate change mitigation and adaptation ultimately depend on the choices humanity makes and the priorities set on a global scale. The Paris Agreement of 2015, together with earlier global initiatives undertaken under the UNFCCC (1992), already provide critical pointers to tackling the reality of climate change as a ‘common concern of humankind’ (UNFCCC, 1992: preambular statement number 1). The envisioned climate actions are generally aimed at ensuring improved ecosystem services as well as natural capital value ‘for the benefit of present and future generations’ (UNFCCC, 1992: principle number 1). As has been stated in global meetings and enshrined in global agreements, some of the necessary actions could be buttressed by the adoption of ‘low-carbon and zero-carbon energy technologies’ and eco-initiatives as best practices; examples of these are discussed in the sections below. In particular, agricultural and aquacultural best practices could reduce water pollution and limit climate change impacts, while also mitigating against climate change by acting as carbon sinks.

The SBEC 2018 called for discussions on issues around the policies, and legal, regulatory and institutional frameworks that could be implemented to reduce aquatic pollution. Discussion is also needed on the best strategies and enabling conditions to support the implementation of the ‘polluter pays principle’ within developing economies. The types of innovative small-, medium- and large-scale technologies and financial mechanisms that support the sustainable management of aquatic resources, coastal resilience and pollution reduction also need to be reviewed. Other discussions were expected to revolve around key factors that drive effective and sustainable public–private partnerships in order to reduce the pollution and climate change and how the existing multilateral environmental agreements should

be best implemented to sustainably manage aquatic ecosystems. Finally, the actions the international community needs to take in order to stop the flow of plastics and marine in the aquatic environment, including how to turn waste management into attractive business opportunities especially for women and the youth, were reviewed.

This chapter is largely based on a synthesis of some of the main presentations delivered and covers some lesson-bearing initiatives and steps already being made globally. We highlight specific examples that aim to contribute to the mitigation of climate change within coastal ecosystems and create resilient environments. These are in line with the relevant international instruments, such as the Paris Agreement (2015) and each country's nationally determined contributions (NDCs).²³ (For specific examples, see sections 4.3–4.6 of this chapter).

4.2 The IUCN presentation on climate change effects on the global ocean

Tampering can be dangerous. Nature can be vengeful. We should have a great deal of respect for the planet on which we live. (Carl-Gustaf Rossby, 1956)

4.2.1 Background

Carl Gustaf Lundin, Marine Science Advisor at International Union for the Conservation of Nature, (IUCN), presented on 'Climate change in the ocean'. He discussed the effects of climate variability in the ocean and gave an overview of the climate change programmes that IUCN is implementing in its marine programme. The presentation highlighted that the effects of climate change are real and so there needs to be continuous efforts to restore ecosystems and use the environment in a sustainable manner if socioeconomic benefits are to be assured. Within its current thematic priorities in the marine and polar programme, IUCN works to ensure that the ocean ecosystems are restored and maintained through sustainable and equitable use of their resources. The IUCN aims to ensure that the conservation of these polar and marine ecosystems is coherent and undertaken within the frameworks provided by national climate change adaptation and mitigation policies.

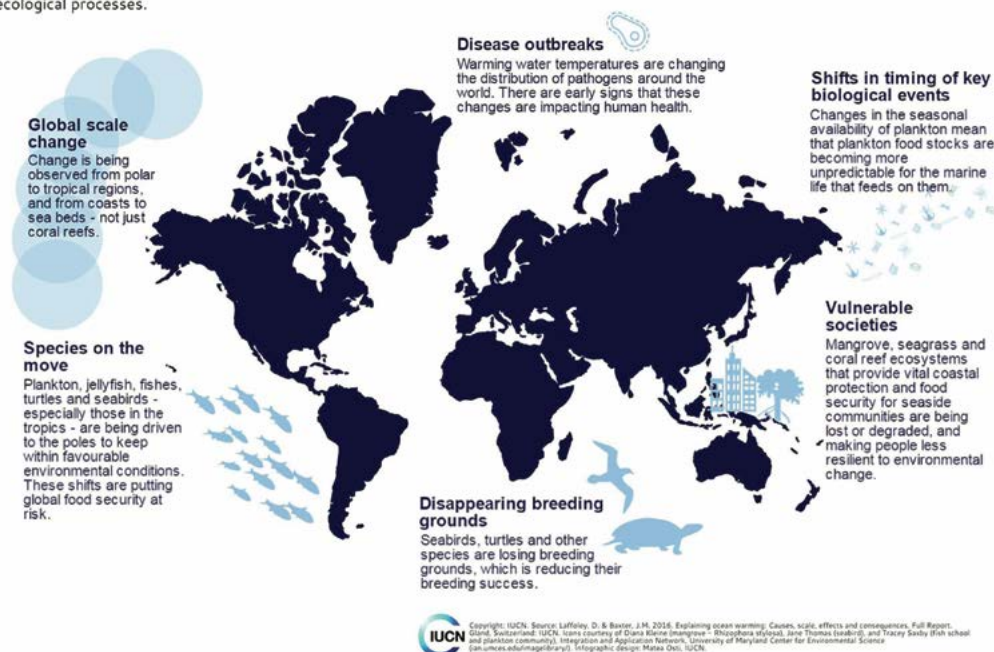
IUCN has prioritized three main organizational projects which address the threats to the world's oceans. Within the **ocean acidification programme**, for instance, IUCN has a high-level scientific committee that delivers the latest science for resource management and policy advice. The **marine plastic programme**, funded

²³ As the UNFCCC puts it, the NDCs are at the heart of the Paris Agreement in which states agreed to a long-term goal for adaptation, 'to increase the ability to adapt to the adverse impacts of climate change and foster climate resilience and low GHG emissions development, in a manner that does not threaten food production.' Additionally, they agreed to work towards making financial flows consistent with a pathway towards low GHG emissions and climate-resilient development.

by the Swedish International Development Agency focuses on building cross-sector collaboration to conduct research and build innovative and practical solutions. The primary aim of the latter is to address the issue of marine plastics within East African, Asian, Baltic and Mediterranean waters. The **Blue Carbon project** facilitates and recognizes the role of blue carbon ecosystems (BCE) in mitigating climate change, while creating resilient ecosystems.

A warming ocean

Since the 1970s, the Earth's ocean has absorbed more than 93% of the enhanced heating arising from human activities. This extra heat is causing changes in the ocean, which are beginning to alter species, ecosystems, and ecological processes.



The presentation outlined how Earth's ocean has absorbed more than 93% of the enhanced heat from anthropogenic activities, causing variation in the ocean and its associated ecosystems (Laffoley and Baxter, 2016). On a global scale, the change is being felt from the polar to tropical oceans and from coasts to seabed. This sees the migration of species – such as plankton, jellyfish and others in the tropics – driven to the geographical poles to keep within favourable environmental conditions. The breeding success of certain species, such as seabirds, turtles and related species decreases due to the loss of their breeding grounds. Warming water temperatures change the distribution pattern of pathogens globally, which impacts human health due to disease outbreaks. The shift in timing of key biological events, such as the seasonal plankton availability, means that these food stocks are inadequate and unpredictable for marine life that depends on them. Coastal

communities have become less resilient to climate variability because the BCEs, such as mangroves, sea grasses and coral reefs, that are vital for coastal protection have been degraded by human activities.

4.2.2 In search of sustainable financial mechanisms

The presentation also covered ‘sustainable financial mechanisms’ that provide long-term funding and, in turn, create the enabling conditions for blue growth. Specific reference was made to financial organizations such as the Blue Natural Capital Financing Facility. This provides funding for actions that restore, conserve and enhance natural ecosystems by offering better support for climate adaptation and mitigation initiatives, while protecting coastal biodiversity and allied marine natural resources. Another example is the Save Mangroves Now Alliance that was created as a joint partnership between the World Wildlife Fund (WWF), the IUCN and the German Federal Ministry for Economic Cooperation and Development (BMZ). This fosters synergies that help global efforts to reduce mangrove ecosystem degradation and meet the target set by the Global Mangrove Alliance to increase the global area of mangrove habitats by 20% in 2030. Other programmes include the Blue Action Fund and BEST.²⁴

Lundin concluded by stating categorically that although the world’s oceans are experiencing unprecedented change, there are promising potential solutions to the environmental problems, although in some cases, it would take decades to reverse the problems. IUCN and its global membership are ready and willing to provide the support needed to deal with these environmental challenges.

4.3 Mainstreaming blue carbon ecosystems into national development and climate change agenda

4.3.1 Background

James Kairo of the Kenya Marine and Fisheries Research Institute (KMFRI) gave a presentation on the ‘Mainstreaming of blue carbon ecosystems into national development and climate change agenda’. The presentation provided a background and overview of the global distribution of the ‘blue carbon’ ecosystems’, specifically seagrass, saltmarshes and mangroves, based on studies by Pendleton and colleagues (Pendleton et al., 2012: Figure 1). Blue carbon ecosystems are important because they contribute towards healthy coastal ecosystems store and sequester carbon, support coastal communities, and contribute towards both climate mitigation (as degraded coastal ecosystems release carbon) and adaptation strategies, thereby

²⁴ The Blue Action Fund is a conservation trust that focuses on assisting management of marine protected areas and coastal waters of Asia, Africa and Latin America.

being critical to the achievements of the sustainable development goals. Studies have shown that BCEs such as mangroves, are significant carbon sinks and serve an important role in mitigating climate change. Studies have shown that per unit mean carbon storage in BCEs are much higher compared with the terrestrial forests (Fourqurean et al., 2012; Pendleton et al., 2012).

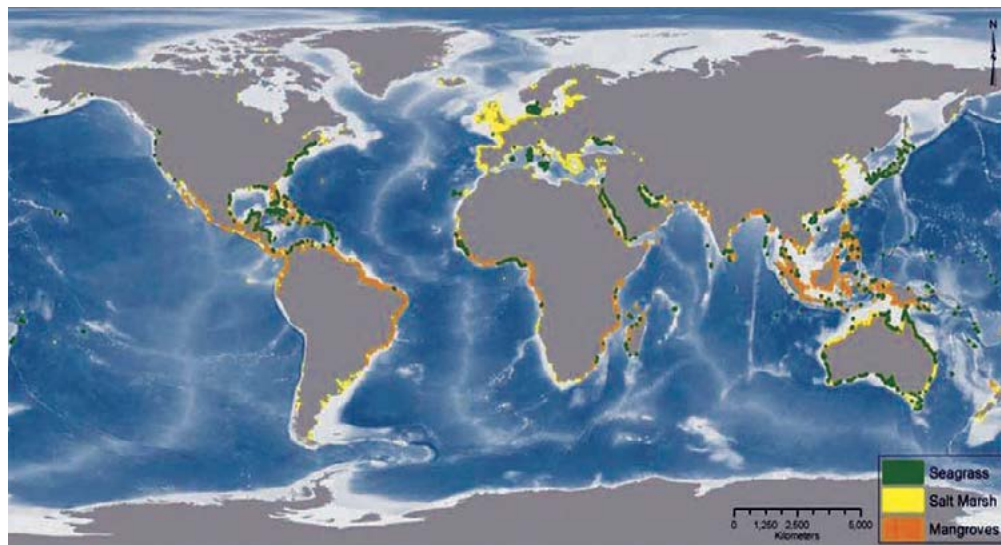


Figure 1. *Global distribution of blue carbon ecosystems* (source: Pendleton et al., 2012)

Kairo described a project being implemented in Kenya which is specifically focused on the climate change agenda. The project, which is a local mangrove restoration initiative, is called the Mikoko Pamoja. It is a community-based REDD+ restoration²⁵ and conservation project along the coast of Kenya, based at Gazi Bay. The project supports local communities in reforestation and promotes actions that prevent the degradation of the local mangrove forest. All profits from the project are invested back into community development initiatives. The project is considered as the first mangrove ‘payment for ecosystems services’ carbon scheme in the world. The project’s activities include restoration of degraded mangrove forests and surveillance of stands against illegal activities (through involved monitoring, education and awareness raising and the projected sale of carbon credits).

Kairo explained that mangroves are beneficial to both the surrounding communities and the environment. They provide habitat for fish and ecosystems services, such as coastal protection, biodiversity improvement, water purification and sequestration of carbon dioxide. The income accrued from the mangrove

²⁵ REDD + references reducing emissions from deforestation and degradation and the role conservation plays. It involves sustainable forest management and enhancement of forest carbon stocks in developing countries. The decision on REDD agreed at the 2007 UNFCCC in Bali, Indonesia (decision 2/CP.13). Decision 2/CP.13 acknowledges that forest degradation also leads to emissions and needs to be addressed when reducing emissions from deforestation.

forest resources in the form of carbon credits safeguards these benefits for the community in a sustainable way, creating resilient communities and ecosystems.

The Mikoko Pamoja project has been successful in meeting its objectives. This is evident within the local community in terms of job creation and upscaling of community services, such as education, water, sanitation and hygiene facilities. Other indicators of success include local livelihood support through ecotourism initiatives and the provision of energy efficient stoves for locals. The environmental benefits have included the successful mangrove restoration that sequesters much carbon from the atmosphere. Continuous conservation efforts maintain the role of coastal ecosystems as long-term carbon sinks to ensure that no new emissions emerge from their loss and degradation.

Kairo observed that the project can also create a stimulus for new carbon sequestration through restoration of previous rich coastal habitats. The approach of the Mikoko Pamoja initiative has been replicated in another BCE on the coast of Kenya, at Vanga Bay, which is a few kilometres from the Mikoko pilot site. Additionally, useful policy recommendations, as seen from the outcome of the pilot project, have been presented to the Government of Kenya. This has resulted in the inclusion of BCEs in Kenya's national development and climate change policies, such as its NDC under the Paris Agreement. Institutional capacity and awareness within all levels of the community creates an understanding of the true value of these BCEs. Kairo concluded by stating the need for increased scope of reach for such initiatives, as well as increased funding for restoration and management of BCEs.

4.3.2 Incorporating mangroves in NDCs and underlying policy considerations

The presentation also highlighted another project that KMFRI and partners, including the WWF, Kenya Forestry Service and Pew are implementing, which aims to demonstrate the potential of mangroves in Kenya's NDCs. The two main objectives of the project are:

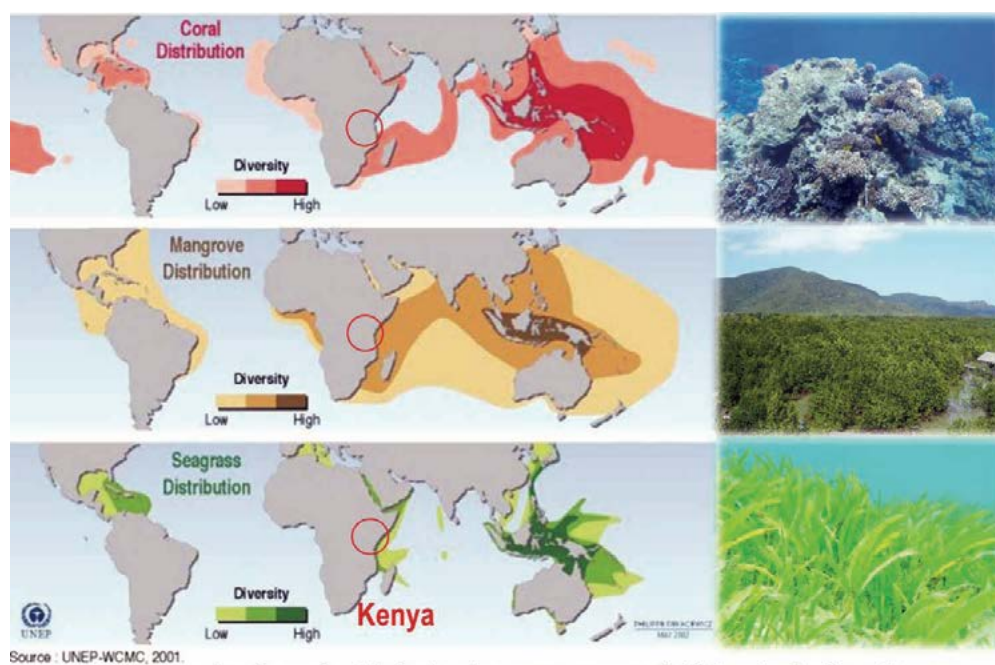
- **to scale up and accelerate conservation of BCE** for the benefits of climate change mitigation, community livelihoods, and biodiversity conservation;
- to generate scientific information that will be used to **inform and ensure that mangroves are part of Kenya's NDCs.**

The policy considerations behind the initiative include the need to ensure that BCEs are incorporated into national development and climate change policies, and especially the NDCs. A pilot project is underway in Kenya's coastal town of Lamu. The project is also expected to enhance understanding, at all levels, of the true value of BCEs, build local capacity on the science, and facilitate increased funding for restoration and management of BCEs.

4.4 Blue carbon restoration, adaptation and mitigation initiatives

4.4.1 Background

Dr. Atsushi Watanabe of the Ocean Policy Research Institute of the Sasakawa Peace Foundation, gave a presentation on ‘Mainstreaming blue carbon policy for the realization of resilient coastal community and blue economy in the era of climate change’. The presentation highlighted some restoration initiatives that are aimed at mitigation and adaptation to climate change in diverse locations in Japan and Palau. These were shared as case studies of how the blue carbon ecosystem (BCE) can mitigate the serious effects that arise from climate change, and provide adoptable strategies that can be replicated and shared with other coastal communities.



BCEs can be found widely in the east coast of Africa including Kenya.

Source: presentation at SBEC 2018 on ‘Mainstreaming Blue Carbon Policy for the Realization of Resilient Coastal Community and Blue Economy in the Era of Climate Change’ by Atsushi Watanabe (Ocean Policy Research Institute (OPRI-the Sasakawa Peace Foundation))

In defining the concept of BCEs, Watanabe referred to the global distribution of coral reefs, mangroves and seagrasses pointing to the areas of richer ecosystem diversity. Watanabe stated that healthy BCEs, especially mangroves and seagrass beds, absorb CO₂ from the atmosphere and store it within their soils or export it to the interior of the open ocean, which can sometimes sequester CO₂ for thousands of years. Thus, healthy BCEs are believed to mitigate global warming. He further

asserted that BCEs not only mitigate climate change, but also help coastal areas adapt to climate change impacts. For example, healthy coral reefs can keep up with the sea-level rise to some extent, and can act as a natural breakwater against waves and protect coastal areas from erosion.

Land-based pollutions, such as nutrient or soil runoff, can be buffered by coastal vegetation such as mangroves and seagrasses. The impact of ocean acidification or global warming can sometimes be attenuated by the coastal vegetation, through the CO₂ absorption or shadowing effect of these ecosystems. Watanabe also stated that according to the BCEs report published by the United Nations Environment Programme (UNEP) in 2009, ‘coral reefs are not included explicitly as a part of the traditional blue carbon ecosystems. But in the tropics, coral reefs often distribute near seagrass beds and mangrove forests, and therefore is strongly linked to blue-carbon ecosystems’ and so can be included as a part of BCEs. To illustrate this, Watanabe presented project examples from Japan and the Pacific Island of Palau, which are elaborated below. He noted that the Ocean Policy Research Institute is collaborating with partners to undertake further research on BCEs to promote and diffuse sustainable blue economy.

4.4.2 Example 1: restoring seagrass to revitalize local community through fisheries (Okayama, Japan)

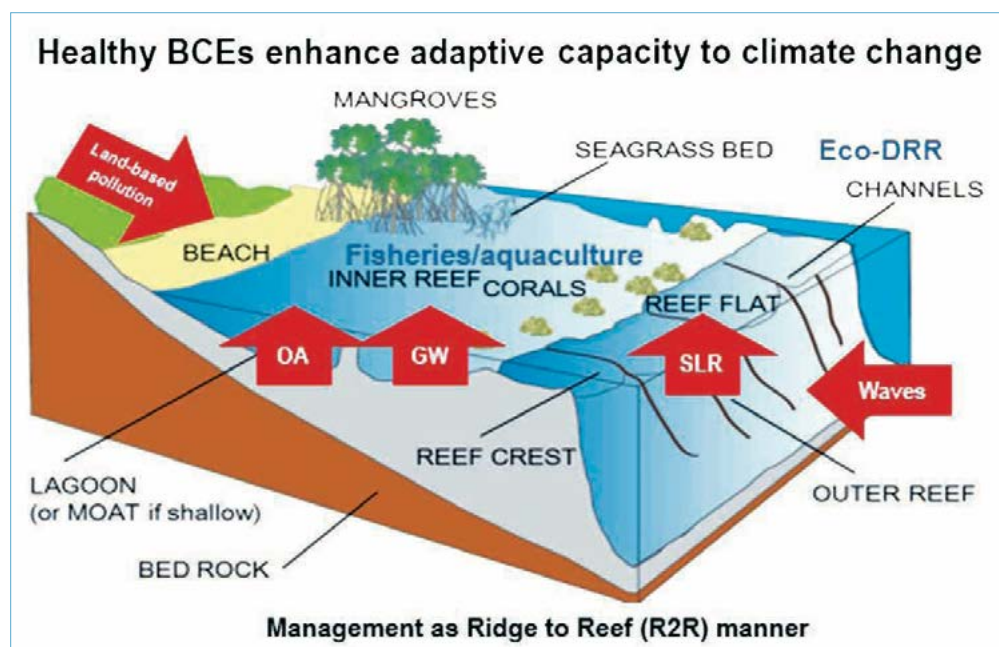
In the 1950s, there were dense seagrass beds around Hinase, a city in Okayama, Japan. These covered an estimated area of 590 ha. However, this declined over the years due to human activities, including coastal development, land reclamation, and water pollution, reducing the area to about 12 ha by 1985 (i.e. about 2% of the portion covered in 1950). Similarly, data from fisheries estimates indicated the catch had decreased between 1940 and 1980. This made the local fishermen aware of the importance of seagrass beds as an avenue for increased fish resources prompting them to initiate actions for the rehabilitation of the ecosystems with support from the local government. The collaborative voluntary effort by the local fishermen saw a steady increase, with the recovery of seagrass area to about 250 ha in 2016. Fisheries for swimming crabs, red sea bream, and squid, whose survival was associated with seagrass beds, saw dramatic recovery.

The subsequent recovery of the seagrass beds saw the stabilization of the oyster harvest, creating a win-win relationship. The oyster ramp dampens wave action and protects seagrass beds. Oysters grazing on plankton increase the transparency of the water column, which is beneficial to sea grass growth due to light infiltration. The presence of extended seagrass beds decreases water temperatures in summer, as a result of the shadow effect on the sea surface. Fauna, such as diatoms, attached to the seagrass beds offer nutrition to the oysters.

In addition to the activities undertaken by the local fishermen is seagrass rehabilitation, local high schools have included the restoration efforts into their curriculum. This involves interviews with the fishermen to learn more about the activities done towards the initiative and the marine environment adjacent to their schools. The work done by the local fishermen for the last 30 years and beyond has created a resilient ecological and socioeconomic system in the region.

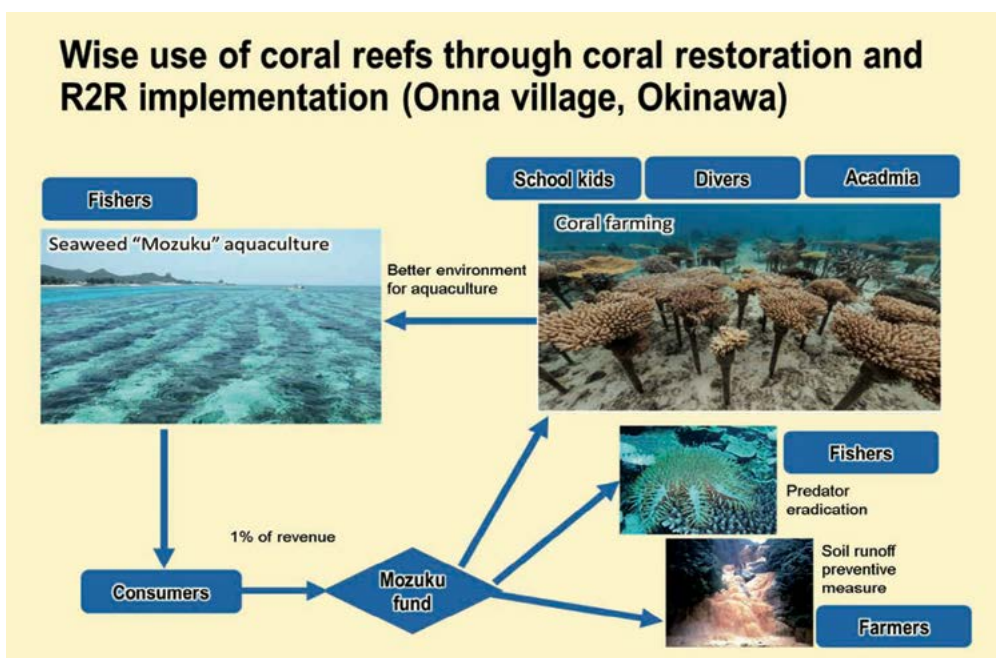
4.4.3 Example 2: wise use of coral reefs through coral restoration and ridge to reef implementation in Onna village, Okinawa, Japan

In Okinawa, Japan there has been the utilization of corals through restoration by use of a ‘ridge to reef’ approach (R2R). In the coastal village of Onna, which attracts many domestic and foreign tourists, there was massive damage to the corals from the 1998 coral bleaching event. Over the last 40 years, local fishermen have cultured mozuku, a type of seaweed, and have observed that the mozuku harvest increases when corals are healthy. As such, much restoration to the corals has been done since early 2000 by transplanting the mozuku to the reefs.



Source: presentation at SBEC 2018 on 'Mainstreaming Blue Carbon Policy for the Realization of Resilient Coastal Community and Blue Economy in the Era of Climate Change' by Atsushi Watanabe (Ocean Policy Research Institute (OPRI)-the Sasakawa Peace Foundation)

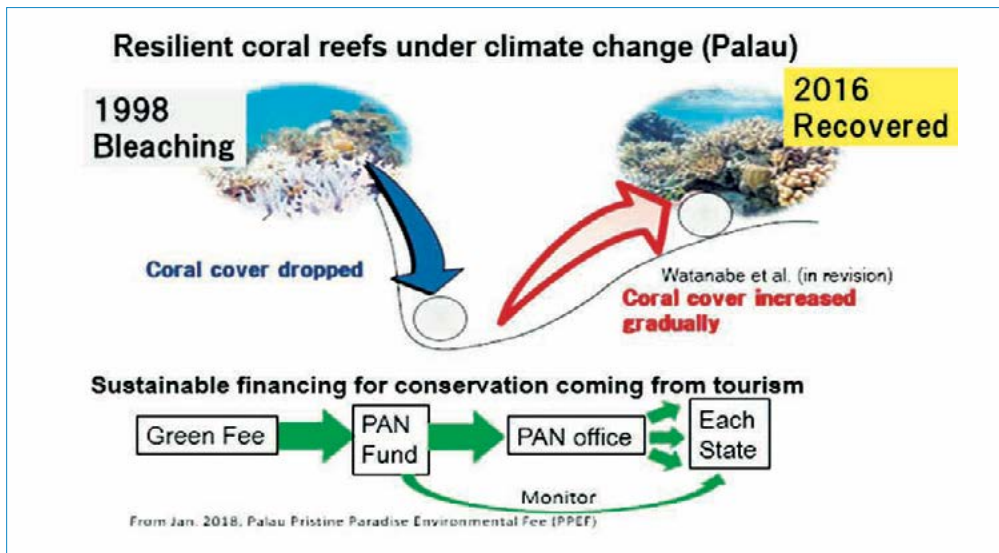
This initiative has received support from the local consumers' cooperative. Mozuku is sold throughout Japan and roughly 1% in revenue is donated to support coral plantations and measures to reduce soil runoff and eradicate predators in the marine environment.



Source: presentation at SBEC 2018 on 'Mainstreaming Blue Carbon Policy for the Realization of Resilient Coastal Community and Blue Economy in the Era of Climate Change' by Atsushi Watanabe (Ocean Policy Research Institute (OPRI)-the Sasakawa Peace Foundation)

4.4.4 Example 3: Coral restoration programme in the Pacific Island of Palau

An initiative to promote the restoration of coral reefs around the Pacific Island of Palau has been implemented through the Science and Technology Research Partnership for Sustainable Development (in short SATREPS) project. This is funded by the Japan Science and Technology Agency and the Japan International Cooperation Agency. The project yielded research indicating increased ocean acidification in the region's ocean over the last two decades and accelerated warming over the last 80 years or more. However, the corals in Palau are resilient to this climate change. In 1998, the coral cover dropped to one-third due to bleaching and death but, after this, the coral cover recovered over time, reaching about three-quarters of its original area. By using the sustainable financing mechanism Green Fee, many measures have been enforced to conserve coral reefs in the area. The fee is paid by visiting tourists and directly channelled to the Protected Area Network (PAN) fund and distributed to all states through the Network's administration office. This fund is controlled by the government, which additionally monitors each state's progress. These activities enable tourists to contribute indirectly to coral reef restoration, thus giving them a sense of pride in the efforts to protect the ecosystem.



4.5 The seaweed initiative for enhancing climate resilience

4.5.1 Background

Pål Bakken of the SeaForester Initiative gave a presentation on ‘The regeneration of ocean forests: the importance of seaweed’ chronicling the SeaForester’s global advocacy on the importance of seaweed forests, an ecosystem that is often overlooked, despite accounting for 60% of marine vegetation. The presentation highlighted that the seaweed forest is largest in developing countries and is characterized by having no conflicting interests, while being an enabler of blue economic growth and development. Sea forests are beneficial as they tap into social issues, such as creating healthy environments, enhancing human health and wellbeing, and contributing to food security, in addition to creating jobs.

Bakken noted that in comparison to rainforest ecosystems, seaweeds sequester over five times more carbon per unit area. Unfortunately, these precious ecosystems are degraded due to ocean warming, heat waves, coastal development, pollution, agricultural runoff, the presence of invasive species, overfishing and grazing. However, these threats can be mitigated by factors, such as direct ocean seeding, seeding on stones, the use of artificial structures, temperature tolerance breeding and cultivation.

4.5.2 Example: ‘SeaForest Portugal’ project to pilot seaweed conservation

A successful pilot programme on the use of seaweed to increase climate resilience has been successfully implemented in four locations along the Portuguese coast. The projects involved the testing of various seeding methods and planting four types of seaweed in four locations along the Portuguese coast. The project has been made possible with the assistance of SeaForester partners such as Nature

Conservancy, the Norwegian Institute for Water Research, *Instituto Português do Mar e da Atmosfera* and the *Instituto da Conservação da Natureza e das Florestas*. SeaForester's monitoring and analysis team is mandated with the creation of an online open databank, implementation of a common monitoring methodology, and satellite and underwater monitoring of the seaweeds, as well as seeking collaboration for ongoing projects and partnerships with industry leaders.

4.6 Protecting and restoring seagrass meadows

Sophia Johannessen and Robbie Macdonald of Fisheries and Oceans Canada gave a presentation on the importance of the protection and restoration of seagrass meadows in carbon sequestration. They noted that if the carbon sequestered by seagrasses is overestimated, net carbon emissions might increase due to too many high carbon credit claims.

The Marine Litter Action Plans for Commonwealth States supports the Commonwealth Clean Oceans Alliance through evidence gathering, capacity building and knowledge transfer. An overview of the work done was presented by Stuart Rogers and Thomas Maes of the Centre for Environment, Fisheries and Aquaculture Science, United Kingdom. The influence pollution has on coastal habitats is an important factor to consider when improving resilience.

According to Koen Vanstaen of the Commonwealth Marine Economies programme, marine ecosystems across the Pacific are increasingly affected by stressors such as pollution, overfishing and more frequent extreme weather and warming events. This leads to ongoing and prevalent degradation of many Pacific marine ecosystems. It is thus important to understand the vulnerability of this regions and the extent to which management actions can help build ecosystem resilience and maintain ecosystems service provision.

4.7 Climate change and the fisheries sector

Charlotte de Fontaubert, a Fisheries Specialist at the World Bank, presented on the 'Impacts of climate change on the blue economy', with an emphasis on fisheries. The presentation showed how climate variability affects the fisheries sector and included an overview of how the impact of climate change is felt across different sectors and ecosystems, such as coral reefs, mangroves, small-scale fisheries and tourism. Referencing Organisation for Economic Co-operation and Development (OECD) data, de Fontaubert reported that ocean-based industries contribute about US\$1.5 trillion (2.5%) to the global gross value added. Of this amount, US\$31 million goes to direct full-time jobs as of 2010, contributing to about 1% of the global work force. Industrial capture fisheries are the largest employers in this sector (making up about 36%), followed by maritime and coastal tourism at 23%. In the distribution of jobs, offshore oil and gas represents less than 2% of the total number of jobs.

In terms of the assessment of the value of fisheries, there is need to look beyond the value of landing for three reasons. First, the value of catches is very difficult to measure accurately and to compare. Second, catch data do not typically include illegal, unreported and unregulated (IUU) fisheries, subsistence and recreational catches. Lastly, because, according to a 2012 World Bank report²⁶, the majority of profits is in post-harvest activities (processing) rather than capture. Other significant ways to evaluate fisheries is through job creation, income generation for women and the multiplier effect. According to de Graaf and Garibaldi (2014), an estimated 10% of the global population derives its livelihood from fisheries, with a conservative estimate for Africa indicating that 6.4 million jobs are from small-scale fisheries. On income generation for women, the estimate given is very conservative, about 28% of the workforce.

De Fontaubert reviewed the impact of climate change on different marine resources, such as the consequence on the spatial distribution of species, structure and dynamics of food webs, effects on phenology and physiology, and, lastly, the impact on fisheries catch, landed value, food security and employment. Citing Cheung et al. (2008), the presentation highlighted that predicting the potential of future catches depends on several factors, such as the projected future primary production and phytoplankton community structure, the future species distribution and ecophysiology. The audience was challenged to consider a case scenario based on certain unanswered questions on what really works in fighting ocean-based climate change. For example, does either adaptation or mitigation work, or should both be considered simultaneously? Decision-making tools involve a lot of uncertainty and the priority should be addressing poverty. De Fontaubert concluded by calling for collective action now, pointing out that future adaptation should be envisioned in terms of adaptation versus a much-needed fisheries reform. It should also target stock recovery or protection of key coastal ecosystems. Lessons can be learnt from the Food and Agricultural Organization of the United Nations (FAO) model that gives three categories of adaptation activities from analysis of case studies, namely institutional adaptation, livelihood adaptation, and risk reduction and management for resilience. The presentation also referred to components of adaptive capacity, such as assets, flexibility, social organization, learning and agency as described by Cinner et al. (2018).

4.8 Capacity building needs and knowledge for climate change impacts on fisheries

Jackson Efitre of Makerere University, Uganda, gave a presentation on ‘Building capacity through mainstreaming climate change in curricula of tertiary training institutions in Africa’. He pointed out that climate variability and change presents major environmental, social and economic challenges and, hence, contribute

²⁶ See, <https://documents1.worldbank.org/curated/en/515701468152718292/pdf/664690ESW0P1210120HiddenHarvest0web.pdf>



Ms. Maimunah Mohd Sharif, Under Secretary General and Executive Director, UN-HABITAT presents UN-Habitat's commitment statement at the high level segment of SBEC 2018.

to poverty and food insecurity. He restated the commonly held view that Africa is the most vulnerable continent due to its high levels of poverty, dependence on climate sensitive agriculture and natural resources, and limited adaptation capacity. He went on to state that if action is not taken now to address the impacts of climate change, Africa is not likely to meet the SDGs. In Efitre's view, the major challenge is inadequate knowledge, training and institutional capacity in higher education institutions in Africa to address the effects of climate change on fisheries. Accordingly, he called for capacity building to generate knowledge, train personnel and increase awareness through the mainstreaming of climate change into the curricula of training institutions. Efitre shared the example of a partnership between Makerere University and the National Fisheries Resources Research Institute, through a project funded by the Rockefeller Foundation, that has developed a training manual to build capacity in climate change and fisheries.

Stressing further the need for training, Efitre decried the minimal attention paid to the impact of climate change on fisheries, emphasizing the need for a climate change training manual. This should strengthen existing efforts to address the effects of climate change on fisheries and prioritize them as a special case, similar to the attention afforded to natural resources. This, he argued, is necessary because of the high economic importance of fisheries. Furthermore, Efitre observed, international, regional and national policies and programmes have recommended incorporating climate change into training programmes. The overall goal is to provide guidelines on how to mainstream climate change issues in fisheries and aquaculture training in higher education institutions. This would equip students with the technical capacity to evaluate changes in climate and its impact on fisheries resources. It would also increase the human resource capacity needed to address climate change issues by reviewing and strengthening national education systems.

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Chapter 5

Smart Shipping, Ports, Transportation and Global Connectivity

5.1 Global transportation and connectivity in perspective

Prior to the sudden onset of the COVID-19 pandemic in 2020, which undoubtedly put much pressure on general global transportation and connectivity, transportation, particularly maritime transport, essentially transformed and connected societies worldwide. As the cheapest form of bulk transportation, shipping and seaports have been at the forefront of economic development. They account for over 90% by volume and 70% by value of global trade.²⁷ Maritime transport and the related developments in transport technologies are therefore crucial players in the global economy with direct links to the prosperity of many countries. Moreover, the globally adopted 2030 Agenda for Sustainable Development underscores the role of seaborne trade as an engine for inclusive and sustainable growth and development (UNCTAD, 2018). In both Agenda 2063 and the 2050 Africa Integrated Maritime Strategy (AIMS), the African Union (AU) has recognized marine resources and energy as well as ports operations and transport as presenting immense potential if fully developed. AIMS also focuses on how to develop and utilize Africa's marine resources.²⁸

Maritime transport services create job opportunities in, among other areas, shipping, ship building and repairs, vessel registration, sea-faring, port operations, insurance, shore-based auxiliary support and financial services. Maritime transportation in developed economies attracts huge investment in infrastructure and operations, and emerging economies have raised their level of participation by building the necessary capacity in those areas. Countries looking to increase their participation in global transportation must, out of necessity, not only improve their physical and electronic connectivity, but also work on the regulatory framework and environments as part of the strategy for building global competitiveness. Beyond this, international cooperation and partnership building is needed, if only because the financial investment required in building an effective and efficient maritime transport system is often beyond the capacity of most countries acting on their own. In this context,

²⁷ United Nations Conference on Trade and Development (UNCTAD) data. For the African context, see UNECA (2016).

²⁸ For Agenda 2063, see AU (2015) and for AIMS, see AU (2012).

governments, particularly those in the least developed countries (LDCs) need to understand, the determinants of efficiency in different transportation modes and the intermodal interfaces, which can, in turn, enable them to develop informed supportive policies and frameworks. Lastly, it is as important to understand the differentiated impacts of transportation and connectivity on various developmental stages and country-specific characteristics in order to develop tailored solutions. For instance, the ratification and adoption of relevant international conventions and instruments is essential for assuring orderly growth and facilitating assurances of sustainable environmental responsibility for posterity.

5.2 Trade, maritime connectivity and global value chains

One of the key messages from the SBEC 2018 Science and Research Symposium was the imperative to increase marine transport and seaborne trade in order to create jobs, including employment in supporting services.²⁹ Access to foreign markets is a critical determinant of trade performance and, consequently, the economic development of a nation. Direct maritime connections play an important role in determining trade and related transaction costs. High transport costs continue to impede LDCs' trade competitiveness and access to global markets. Enhancing maritime connectivity will thus strategically stimulate exports and promote the participation of the domestic economy of these nations in global chains of production.

Research emphasizes the importance of transport costs and infrastructure in explaining trade and access to international markets. In turn, reduced supply chain costs and greater competitiveness of firms enables better participation in global value chains (GVCs). Estimates of trade costs are derived from the observed pattern of production and trade across countries. The results show that maritime transport connectivity and logistics performance are very critical determinants of bilateral trade costs,³⁰ both being more important sources of variation in trade costs than geographical distance.

While roads and railways connecting production sites, power plants and industrial parks can make countries more attractive for investment and trade, African countries must continually plan and multilaterally negotiate for infrastructural projects with a regional dimension that increases both intra-Africa trade and connects regional industrial chains to the world.

GVCs powered the surge of international trade after 1990 and now account for almost half of all trade. This shift enabled an unprecedented economic convergence where

29 Official Report of the Global Sustainable Blue Economy Conference, 2018. Ministry of Foreign Affairs, Government of Kenya

30 See UNCTAD's Liner Shipping Connectivity Index (LSCI) and the World Bank's Logistics Performance Index (LPI). <https://unctad.org/news/maritime-connectivity-countries-vie-positions> and <https://lpi.worldbank.org>

poor countries grew rapidly and began to catch up with richer countries (UNCTAD, 2020). Today, almost 50% of global trade involves GVCs. GVCs can further boost inclusive and sustainable growth, create better jobs and reduce poverty, if developing countries speed up trade and investment reforms, and increase maritime connectivity while the industrial countries pursue open, predictable policies. To this end, Africa and the LDCs have an opportunity to negotiate for regional connectedness in order to drive a geographical concentration of value added.

5.3 Key questions at SBEC 2018

The Science and Research Symposium attempted discussed closely related issues, in order to answer the key questions:

- How can countries attract and maintain sustainable and climate change-resilient investments in the underutilized areas of maritime transport?
- How can we enhance environmental and social corporate responsibility and accountability measures?
- How can the transportation potential of inland waters be developed to enhance hinterland connectivity?
- What kinds of incentives are needed to strike a balance in the use of fossil fuels and renewable energy to drive the transport sector?
- What opportunities do ports and shipping lines have to enhance global maritime connectivity and how can this be done?
- What measures are needed to integrate women, youth and marginalized populations into the mainstream maritime transport sector?
- How can access to technological milestones and innovations be enhanced to promote energy efficiency in maritime transport?

The objective of this chapter is therefore to highlight some of the key responses and inputs that were made. Some responses touched on an overall framework for a sustainable maritime transport system, capacity building and job creation, collaborative partnerships and gender mainstreaming within the sector, and necessary advancements in the shipping industry that are all considered important in facilitating blue growth.

5.3.1 Technology and innovation in the maritime transport sector

The Symposium identified innovations, such as automation, data analytics, robotics and the following technologies, that are changing the face of the maritime industry:



A participant fields a question during the main plenary session of SBEC 2018 at the the Kenyatta International Convention Centre, Nairobi, Kenya


- **Autonomous shipping** could reduce contact in freightage, especially in the wake of COVID-19 and minimize the likelihood of contagion. Autonomous ships and semi-autonomous vessels reduce human error, decrease crewing costs, increase the safety of aquatic life and increase fuel efficiency.
- **Virtual reality** process could enhance maritime companies' training programmes and also improve ship and engineering process design techniques by enabling the evaluation of ship interiors remotely and virtually.
- **Augmented reality (AR)** bridge systems could improve navigation safety and efficiency and enable greater flexibility and operational mobility. AR depictions of ships could lead to the end of screens and monitors on a bridge. Therefore, ship inspectors would no longer need to take extra equipment with them; the ship could be inspected remotely using AR. AR enables better information delivery to crew members and reduced risk.
- **Artificial intelligence** could help maritime companies save time and money by automating processes and tasks. For example, the maritime industry is creating applications that will enable autonomous surface vessels to navigate without human control or management.

- **Drones** are used for maintenance and monitoring of automated cranes in autonomous ports, such as in the Port of Singapore where drones feed their data back to engineers on the ground in real time. Tug operators such as KOTUG are using drones to connect towing ropes between tugs and ships ensuring safety, and drones could also play a key role in testing ship emissions.
- **Blockchain** as a distributed ledger technology could revolutionize supply chain logistics and cargo trade in the maritime sector. Shipping companies could use digital currencies and payments for procuring products and trading cargoes, and blockchain can help mainstream this.
- **Cyber security** is a necessity in an industry which carries around 90% of the world trade. In preventing cyber-attacks, it is critical to identify threats and vulnerabilities, assess the risk exposure attached to these matters and develop both protectionary measures and contingency plans to neutralize these risks.
- **E-learning maritime education and training** must conform to current trends and explore e-learning training as a way to improve training performance.

5.3.2 Ports, transshipment hubs and shipping lines for coastal area activities

Ports are an important to economic activities in coastal areas. They support economic activities in the hinterland and create an intermodal transport system connecting the sea, air and land transport. Seaborne transportation is the most affordable and effective transportation system compared to other modes. Most industries in the world are thus located in the coastal regions, close to major ports since industries require a reliable and affordable means of exporting finished goods and importing raw materials. Ports include seaports, intercoastal and inland ports that facilitate movement of goods between the seaports and local communities, and transshipment hubs that connect different regions of the world.

Ports are key water-land interfaces in the logistics chain. They are increasingly becoming important crystallization points for other maritime economic activities such as cruise vessels, coastal shipping, international shipping, passenger ferries, fishing, mining of marine minerals, oil drilling and other offshore economic activities. Port efficiency and connectivity can unlock or undermine economic potential of a country. Today, the race among ports is on enhancing efficiency, with the overall goal of transforming them into hub-and-spoke intersections or relay transshipment hubs. Transshipment hubs generate cost savings from economies of scale, raise port earnings, attract frequent feeder services and create opportunities



for coastal shipping. The degree of transshipment activity of a port is measured by the transshipment incidence, which is the share of the total port throughput that is ship to ship compared with the total throughput that includes hinterland traffic. The transshipment incidence distinguishes between pure transshipment hubs with more than 90% incidence and incidental transshipment hubs with less than 25% incidence (Rodrigue and Ashar, 2015). Other than cargo handling, a well-developed transshipment hub provides incentives to establish industries that intercept cargo for intermediate processing, sorting, repackaging, labelling, sampling, inspecting and valuing.

5.3.3 Renewable energy and maritime transport

The key message emanating from the Science and Research Symposium was simply: ‘less fossil fuels, less carbon emissions and a cleaner future for shipping’. Renewable energy applications may be options for primary or hybrid propulsion, or on-board and shore-side energy use. This could be integrated through retrofits to the existing fleet or incorporation into new shipbuilding and design. When projecting the transport demand for six ship types (dry bulk, container, oil tanker, gas, wet product and chemical, and general cargo) based on the OECD’s global trade projection of 25 commodities, Kirstein and colleagues (2018) tested the impact of mitigation measures on CO₂ emissions until 2035 using an international freight transport and emission model. They presented four possible decarbonization pathways that combine all the technologies available today; the results show that an 82–95% reduction in CO₂ emissions could be possible by 2035. The authors examined the barriers and the relevant policy measures to advancing the decarbonization of international maritime transport, among these is the use of renewable energy. According to these authors, while the individual measures can deliver a significant reduction in CO₂ emissions, it is unlikely that one single measure on its own would be the most efficient and cost-effective way to achieve decarbonization of shipping by 2035. A combination of measures would be needed, which generate different decarbonization pathways.

5.3.4 Inland water connectivity

More than 600 million people (around 10% of the world’s population) live in coastal areas that are less than 10 m above sea level and nearly 2.4 billion people (about 40% of the world’s population) live within 100 km (60 miles) of the coast (UN, 2017). Oceans, coastal and marine resources are very important for people living in coastal communities, representing 37% of the global population in 2017. Africa holds abundant water resources. It has large rivers, including the Congo, Nile, Zambezi and Niger, and Lake Victoria (which is the world’s second largest lake). However, Africa is the second driest continent in the world, after Australasia, and millions of Africans still suffer from water shortages due to problems of uneven distribution and

a lack of infrastructural connectivity between the urban cities and marine ports to the water sources. Enhanced inland water connectivity to cities and ports will aid in transshipments of their produce.

5.3.5 A framework for a sustainable maritime transport system

The International Maritime Organization (IMO) has developed a blueprint for a sustainable maritime transportation system. The system should assist countries in developing their maritime transport infrastructure in an efficient, safe and environmentally sound way,³¹ while also staying in line with the development process of the SDGs. The framework includes a comprehensive and systematic approach for delivery of technical assistance to Member States in the formulation and development of national maritime transport policies. It also aims to strengthen maritime capacities and contribute to the achievement of the SDGs. Annually, the IMO selects a maritime theme that focuses on the importance of shipping safety, the marine environment and maritime security to emphasize its work globally. Shipping has played a significant role in the global economy, but there is need for greater cooperation between shipping and other sectors, such as ports and logistic industries, with the goal of establishing green sustainable supply chains.

5.4 Integrating women, youth and marginalized populations

The SBEC Science and Research Symposium stressed the need to adopt measures, including policies and programmes, that will increase the participation of women and youth in the blue economy sectors. It was also argued that the governance of the blue economy should be people-centred and implemented in a manner that ensures the local communities, including women and youth, are genuine stakeholders (SBEC, 2018).

Two examples of how women and youth and involved in the blue economy in Canada and Kenya were shared. The Canadian example, focused on the Mi'gmaq and Maliseet people along the Atlantic coast of Quebec. Catherine Lambert Koizumi, the Executive Director Mi'gmaq Maliseet Aboriginal Fisheries Management Association, presented research showcasing a sustainable model of collaborative management of fisheries and oceans that includes local and indigenous populations (Koizumi, 2018). The Kenyan example showcased the Kenya Coastal Development Project. The project strives to transform coastal communities through a community-driven development grant programme known as Hazina ya Maendeleo ya Pwani which supports local communities in implementing small-scale projects that can positively transform their lives (Uku, 2018).

31 The LPI and UNCTAD's LSCI both aim in different ways to provide information about countries' trade competitiveness in the area of transport and logistics.

5.5 Significant challenges for shipping and ports

The entire transport sector is an area of great potential but the opportunities also come with challenges. Low shipping connectivity continues to undermine access to global markets. The few, less reliable direct port calls require marked improvement in port efficiency and capacity in order to attract direct port calls. Other key challenges are the increasing concerns around GHG emissions, climate change impacts, marine pollution, piracy, terrorism, crime, illicit trade, human trafficking, cybercrime disruptions and inadequate human, financial and technological capacity. Growing the transport sector and overcoming these challenges calls for the public and private sector to cooperate in building resilient infrastructure, promoting inclusive and sustainable industrialization and fostering innovation in an effective regulatory framework. In addition, the business community can further enhance their role in promoting investments in the sector through deliberate linkages with academia such that research institutions can proactively share knowledge that promotes efficiency, safety and sustainability of investments.

5.6 Thoughts on capacity building and job creation for the maritime sector

Massive opportunities exist within the oceansphere that need to be tapped sufficiently to meet the global sustainability agenda. However, a disparity exists with the labour force lacking the skills required for the jobs. The capacity-building objective should therefore aim to promote integrated marine science education alongside technical-skills building that is rooted within scientific knowledge and hence supports an innovative and environmentally friendly blue economy. In a keynote presentation, ‘Sustainable ocean development and capacity building: leaving no one behind’ to a One-Day Conference on Capacity Building for Sustainable Development for the Ocean Economy, V.N. Attri, Chair in Indian Ocean Studies, Indian Ocean Rim Association at the University of Mauritius, emphasized the need to build capacity within the maritime sector. This should involve focusing on areas of speciality, including related environmental sustainability, and also taking the steps necessary to enhance the overall sustainable development of the blue economy. This involves reinforcing institutional capacity in providing vocational and technical courses in maritime science and technology, while also stimulating innovation for blue growth. Additionally, centres of academic instruction should be established as centres of excellence that act as innovation incubators. These must have facilities in the field. The institutions should also offer cross-cutting courses on maritime advancements, while improving knowledge, technology sharing and innovation among countries at different stages of development. This objective is significant because scientific and technological advances, subsea engineering, satellite technologies, sensors and imagery, big data analysis, bio- and nanotechnology and the advent of autonomous




Executive Secretary of the UN Economic Commission for Africa Ms. Vera Songwe delivers UNECA's Commitment Statement at SBEC 2018.

systems will play a crucial role in the development and mitigation of ocean-related economic and environmental challenges.

Building capacity and innovation in the maritime sector must, however, not be limited to institutions but must also have an interface with governance structures and processes. It should offer an avenue for stakeholder involvement and lead to more effective, inclusive efficient and integrated ocean management. In his presentation, Jeremy D. Prince of Murdoch University in Perth, Australia, recommended the creation of partnerships between the fishing communities and agencies in order to develop the human capacity needed to stabilize and rebuild coastal and lake fisheries. Value adding could then be fostered through supply chains (Prince, 2018). Providing the needed skills within the maritime sector will translate to available human capacity to meet the transport needs within the maritime field, with examples being engineers, environmental specialists and technicians. Overall, the success of these initiatives comes with improved ocean governance regulation and legislation, as some maritime transport sectors face overregulation or a dearth of regulation. As such, sound stewardship in the sector arises from better regulation.

5.7 Global partnerships and case for an African shipping line

In their presentation, the African Ship Owners Association (ASOA), while commending the initiatives taken by various African countries, highlighted the oft-neglected inland waterways and the need to develop their full potential. The initiative



to establish the African shipping lines was commendable and was expected to have its first public outing within the first quarter of 2019. The deliberate use of the word 'African' is necessary because, without it, any opportunities identified could be for non-African shipping lines. The focus should be on the opportunity in global maritime connectivity for wealth creation and distribution, as well as concomitant poverty alleviation. Accordingly, it is important to identify opportunities for wealth creation and distribution by being a partner in global connectivity and to take decisive steps towards this as both African nations and as global partners. ASOA emphasized that a weakness in one area will affect others but recognized the establishment of African shipping lines as a potential catalyst for development. Recognizing the connection between the two is a vital starting point since one waterway does not stop at a dead end. The appreciation that movement of cargo and people, at least in Africa, is and will continue to be dependent on this route. The Intra African Trade Agenda will further increase the vast opportunities that Africa's inland waterways could and should provide. However, ASOA also noted that these steps first require the understanding of, partnerships with and collaborations between global maritime actors. At the continental level, ASOA recognized that many countries (South Africa, Kenya, Mauritius, Cape Verde, Nigeria and Ghana, among others) have already incorporated the blue economy in their development plans and agendas.

5.7.1 The potential of China–Africa cooperation and the Belt and Road Initiative

The Forum on China–Africa Cooperation (FOCAC) is driving cooperation between the two regions. A number of trailblazing initiatives have been launched through this forum, which are geared towards working with and enabling various African countries to tap into their blue economy potential. Up to SBEC 2018, FOCAC's sixth and seventh High-Level Summits and Ministerial Conferences cooperated to develop the ocean economy. The Sixth Ministerial Conference agreed to establish a Ministerial Symposium on Marine Economy under the framework of FOCAC and to:

enhance experience sharing in offshore aquaculture, marine transportation, shipbuilding, construction of ports and port industrial parks, the surveying and exploitation of offshore oil and gas resources, marine environment management, marine disaster prevention and reduction, marine scientific research, blue economy development, and support mutually beneficial cooperation between Chinese and African enterprises, in order to assist Africa to cultivate new economic growth drivers. (FOCAC, 2016)

At the Seventh Ministerial Conference, China agreed to 'continue to provide funds and technical support under the framework of technical cooperation of the

International Maritime Organization and work with African countries to train shipping professionals and strengthen capacity building to promote the sustainable development of maritime shipping' (FOCAC, 2018).

The conference also saw the following developments:

The two sides will actively consider jointly building a China–Africa Cooperation Centre for Ocean Science and blue economy. The two sides will continue to enhance cooperation and exchanges in offshore aquaculture, maritime transportation, shipbuilding and repair, offshore wind power, maritime information services, maritime security, marine resources development, the protection and management of islands, scientific research, ocean monitoring and polar research, among others. (FOCAC, 2018)

China's national marine economic innovation, development demonstration areas and national industrial demonstration bases include the Shandong Peninsula Blue Economic Zone, Qingdao Blue Silicon Valley, and the marine industrial parks and bases in the Yangtze River Delta region. These provide a wealth of experience and lessons learnt that could be applied to the future development of African countries. A paper that was presented at the Symposium by Li Jian, Jiang Bao of the Marine Development Institute, Ocean University of China, analysed the 'green' contribution to environmentally sustainable development after the implementation of Shandong Peninsula Blue Economic Zone Strategy. The author went on to discuss the empirical and analytical methods used to evaluate the success of regional economic and industrial policies (Jian and Bao, 2018; Jian and Jiang, 2018).

A presentation delivered by Duan Xiaofeng, Ministry of Natural Resources, China, outlined the importance of 'blue dependency' for African development. More than 70% of the countries in Africa have a coastline and close to 90% of its import and exports depend on ports and shipping. Two other factors were highlighted: the abundant marine resources and the significant location advantage, which, if properly harnessed, could increase the benefits of the blue economy. Of particular advantage are marine fisheries, the opportunities in ports and shipping, marine energy and marine tourism, as well as the blue economy's contribution to desalination.

The Belt and Road Initiative revives trade routes along China's ancient Silk Road, linking China to the rest of the world, including to East Africa. It presents tremendous opportunities for infrastructural maritime connectivity and industrial development. As of June 2020, a total of 43 African countries had signed cooperation agreements under the framework of the Belt and Road Initiative. The revived trade routes strategically position Africa to diversify its supply chains and create trade connectivity to the China–Indian Ocean–Africa–Mediterranean Sea blue economic

passage linking Africa to new maritime corridors in Pakistan, Bangladesh, Sri Lanka and Myanmar. Africa's opportunity stems from its abundant marine resources and the significant locational advantage, which, if properly utilized, will harness the blue economy industrial wealth and generate immense exports.

5.7.2 Marine economic zone planning: case study of China-Cape Verde cooperation project

Under the umbrella of FOCAC, China has been implementing a 'special economic zone' plan in São Vicente in Cape Verde. The project relies on the advantage and development potential of São Vicente (location, sources, market and environment), combined with the marine national economy development strategy. The project was developed based on the concept of general planning, focusing on important areas, with step-by-step implementation, market orientation and government guidance, as well as ecology priorities and green development.

As a guiding principle for the project, Cape Verde insisted on an emphasis on the ocean in the next decade. This is an important factor in creating national wealth, while enabling the country to better participate in the world economic stage through exploration of a new economic frontier for São Vicente. Overall, the project aims to alleviate rising unemployment and improve the slow economic growth in Cape Verde. The prime geographical location of the country, its available marine resources and political stability are advantageous in meeting its ambitions for blue economic growth in the coming decade. To ensure the success of the project, China drew upon its past experiences and best-case practices; for example, the important role played by the marine economy as an integral part of the national economy through decades of development and wealth accumulation. Furthermore, an integrated marine economic development planning system at different levels with experiences and practices drawn from planning and construction formed a baseline for the project.

According to the law, the aim by 2035 is to transform 'São Vicente into a modern and international island, with great vitality, a model of economic and social development, in terms of ecological environment, use of resources and human living conditions' (CL Brief, 2020). In this initiative, key focus areas include port construction, marine fisheries, ship building and repair, and marine tourism. Spatial layout planning focused on four thematic guiding principles: interactive development of ports, industry and city; inter-coordination of living, productive and ecological functions; intensive utilization of land and marine space; and initiatives for consideration in collaborative development between São Vicente and the adjacent islands.

Lessons learnt from the marine economic zone planning within São Vicente indicate that blue economic cooperation has great potential both conceptually and in



Mr. Justin Mundy, Senior Fellow and Special Envoy for Conflict and Natural Resources, and Sustainable Ocean Initiatives, World Resources Institute (WRI), and Pavan Sukhdev, President, World Wide Fund for Nature (WWF International) in a tagline punch at the opening of SBEC 2018

practice. Moreover, experience and practice sharing for blue economic development cooperation should be encouraged and supported to yield broader, deeper and comprehensive understanding at regional and national levels. Lastly, initiatives for knowledge sharing through joint planning, joint investigation, collaborative research, professional training and expert exchanges will further foster blue economic cooperation.

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Chapter 6

Managing Coastal Zones: Initiatives for Inclusive and Sustainable Empowerment of Coastal Communities, with Special Reference to Kenya

6.1 Why focus on coastal communities is important

One key focus area of SBEC 2018 was the imperative for inclusive development that integrates the livelihoods of coastal communities with the conservation of neighbouring fragile environments. The focus on coastal areas has been recognized in a 'sustainable futures' report prepared under the auspices of the World Wide Fund for Nature (Obura, 2017a). The main point is that, traditionally, products have flowed into and out of countries through their ports, thus making coastal areas naturally attractive. It has also meant that, historically, most of the major cities of the world have been located on coastlines and in valleys of large rivers because of the ease of transportation, availability of food and numerous other ecological benefits. The UN's *Atlas of the Ocean* further reports that 44% of the world's 6.8 billion people live within 150 km of the world's 620,000 km coastline.³² These areas are clearly some of the most productive and biologically diverse on the planet. In fact, some 80% of the 13,200 known species of marine fish are from the coast and are a major source of wealth from fishing and tourism. They are also the gateways of international trade for many countries. Finally, it has long been recognized that oceans are critical to the maintenance of the health of the entire planet's ecosystem, including in carbon sequestration so as to reduce the negative impacts of climate change.³³

Although many expanding coastal communities around the world are dependent on the oceans for their subsistence and livelihoods, they are today engulfed with the pressure of high population growth rates and the increasing flows of tourists. These add to the pressure on coastal land, sea environments and coastal communities generally. As coastal areas get increasingly crowded, the landscapes, habitats and entire ecosystems are altered, overwhelmed and inevitably damaged. The resultant

32 See <http://www.oceansatlas.org/subtopic/en/c/114/>; see also other indications of the lean towards coastal living, <https://www.sciencedaily.com/releases/2016/03/160308105053.htm> and, more specifically, Kummu et al. (2016).

33 See Chapter 4 of this publication for some of the references to the critical role of oceans in carbon sequestration.

consequences include overexploitation and depletion of both freshwater, fish stocks, beach sands and soils. Moreover, coastal wetlands are drained; floodplains around estuaries are reduced by developments; and mangroves and other forests are cut down. The increasing encroachment is also seen in unprecedented littering, with coastal waters teeming with increasing volumes of waste, especially plastics and other rubbish, coupled with sewage that is discharged into the waters. It is thus estimated that one-third of coastal regions are at high risk of degradation, especially from infrastructure development and pollution.

It is clear that the ocean realm is a new frontier for development. It has great promise as a basis for the type of economic growth that can lift millions of people in lower-income countries out of poverty. However, for this to happen, various interventions geared towards empowering coastal communities are vital. Principally, they must include the integration of the health of marine ecosystems with the enhancement of livelihoods of local communities to assure their sustainable and inclusive empowerment. Even so, there are risks, particularly from sectors and companies who adopt the ‘get rich quickly’ mentality without understanding that the long-term vision of sustainability. This requires that marine resources – like all others – should be harnessed in ways that ensure both inter- and intragenerational equity in terms of benefit sharing.³⁴

6.2 Worrying declining health of coastal marine resources

Researchers have increasingly referenced various factors that have contributed to the decline in the health of ocean and marine resources. In the case of Kenya, these include growth in commercial fisheries, conflicts among fisher groups and the increased use of gear, such as ring nets, that damages coral reefs and allows small fish to be caught before they reproduce (Obura, 2017b). Climate change has also exacerbated the decline of coastal and marine habitats, such as coral reefs and mangrove forests. The increased population growth in the coastal zones due to the likely job opportunities in transport and tourism, have all led to economic pressures on Kenya’s coastline. Even with all these factors, it is reported that Kenya earns just about US\$2.5 billion per year from its ocean. This is less than 4% of the national GDP, but also signals the great potential for growth and higher incomes for people living next to the oceans (Obura, 2017b).

6.3 Actions by Kenya for the management of coastal marine resources

Kenya has committed to a number of actions to manage ocean health. The first relates to SDG 14 ‘to conserve and sustainably use the oceans, seas and marine resources for sustainable development’.³⁵ The need to increase income from the ocean has also become a major priority for many African governments with the African Union declaring the blue economy a critical foundation for Africa’s future. In Kenya, one of President Uhuru Kenyatta’s earliest actions was to ensure that the blue economy became a major national priority. The president formed a ‘Blue Economy Task Force’,

³⁴ Both the inter and intragenerational equity have been enshrined as cardinal norms and principles in the entire sphere of sustainable development and immortalized as general principles of international environmental law.

³⁵ See <https://www.un.org/sustainabledevelopment/oceans/>

which was included in a delegation to the United Nations Ocean Conference in 2017. During that conference, Kenya made two commitments: to pursue a future of dedicated focus to the blue economy and to ensure sustainable fisheries from 2018 and beyond.

As part of that second set of actions, Kenya was to prioritize the securing of natural habitats. This drew from international best-practice recommendations articulated by the IUCN that nature should be managed in a state as close to natural as possible,³⁶ as exemplified by the Seychelles Aldabra Atoll. The IUCN also set a global target for all countries to secure 10% of all oceans as protected areas by 2020, even though experts consider this to be just a stepping stone to the final goal, which should be around 30% (IUCN, 2018).

Kenya currently manages just 1% of its ocean territory in protected areas, most of this is in marine reserves that allow fishing.³⁷ It is therefore unlikely that the country will meet the target of 10%, as of 2020. However, by taking steps to empower local communities to manage reserves on the shoreline, combined with setting aside larger offshore areas to preserve fishing stocks for the future, sufficient momentum could be established to reach 30% by 2030.

6.4 Waste management action and cleaning of beaches

The third action by Kenya focused on waste management and included the cleaning of beaches which were littered with plastic and other floating waste. This action confirmed that nationally driven campaigns are needed in order to mobilize the country and return beaches to a clean state. In 2017, the Government of Kenya announced a ban on single use plastic bags.³⁸ Subsequent policy decisions drafted new legal and regulatory frameworks in support of the use of compostable material and confirmed government commitment to eradicating the use of plastics. This vision needs to be more robustly expanded, to a ‘zero-tolerance approach’ to all waste on beaches, most of which is plastic bottles. The total reduction of waste should be done by building better waste management systems and ensuring proper waste collection. Youth working in cottage and other industries should also be promoted as agents of waste collection to complement large-scale commercial recycling operations that can turn waste into useful products for local sale and reuse.

6.5 Lessons from the implementation of mega-infrastructure projects

Infrastructure projects are critical to the opening up, empowerment and integration of coastal communities to larger national economies. The number of infrastructure mega-projects targeting the coast has grown exponentially in the last 15 years. Kenya’s Standard Gauge Railway, the Lamu Port, South Sudan and Ethiopia development corridor project and the Amu Coal Plant are two mega-infrastructure developments of the last few years. Reaction has been mixed, including opposition to the projects by

³⁶ See <https://www.iucn.org/theme/protected-areas/about>

³⁷ See <https://afr100.org/content/community-kenyas-coast-restores-mangroves-food-security>

³⁸ See: <https://www.npr.org/2017/06/08/532022819/kenya-announces-ban-on-plastic-bags>

communities and other interested parties. This suggests that infrastructure projects – important as they are – have to be managed better. It is especially telling that the projects were approved and implemented, despite opposition based on environmental and social concerns. Subsequent court and tribunal hearings to either have the projects stopped or have them improve on their practices have exposed projects to uncertainty. In essence, all these developments imply that strengthening the implementation of environmental impact assessments alongside applicable regulations should always be a priority.³⁹ Moreover, there is a need for adequate skills to develop and promote these requirements among relevant professional bodies and within government. It is thus strongly averred here that, by starting with some of these actions, the Government of Kenya, (and others) could easily take the critical steps required to transform the future of the ocean space.

Beyond 2018, when the historic SBEC was held, it is critical that certain key foundations are laid, especially in respect of every country's ocean resources. Without these, it is likely that long-term sustainability will be impossible for many resources, including those of the marine environments. The presentations made during the conference focused on a number of key initiatives that can be emulated and which have been undertaken in Kenya. These are summarized below.

6.5.1 Case of Watamu: conservation and marine restoration through stakeholder collaboration

Sophie Mbugua (2018) reported on the case of the northern town city of Mombasa, popularly known as Watamu which is often ranked as having one of Africa's best beaches. Watamu's marine protected area is the oldest in East Africa. It is known for its pristine warm waters, bird watching, turtle nesting and reef-protected lagoons. However, the town's famed white sandy coasts were gradually being marred by pollution. The dirty beaches discouraged tourists from visiting the area. As Mbugua related, the tourist industry, community members, researchers and conservationists teamed up to find a solution. This has implications for many other marine life and coasts all over the world. In short, the resultant Watamu Marine Association typifies a collaborative effort between business and communities to clean and restore the beaches and create economic incentives to recycle waste, dispose of non-recyclables and prevent pollution from entering the coastal area. The reduction in plastic and sewage pollution meant cleaner beaches, better nesting sites for sea turtle and an improvement in the environment for local marine wildlife. There is no doubt that the project raised much awareness about pollution, recycling, as well as the crisis of viral infection of turtles and possible treatment options. Watamu is now a model town for waste management.

6.5.2 Case of 'Rocha Kenya: a marine education initiative

Another Kenyan example is the Rocha Kenya, which is a Christian conservation organization that undertakes research and environmental education in coastal Kenya. The organization's main initiative has been to help educate local communities on the need to conserve the environment and prevent plastics entering the sea. Rocha

³⁹ Some of these necessary pre-emptive actions have been summarized in Obura (2017b).

Kenya also lobbied the government to put national policies in place to reduce plastic pollution and subsidize industries that recycle plastics. The project's success lies in having helped create a community that is conscious of the need for a healthy environment and clean beaches.

6.5.3 Case of 'COMENSUM': mariculture for community environmental sustainability

The sustainable use of ocean resources is key for economic growth, improved livelihoods and jobs, while preserving the health of ocean ecosystems. With this in mind, a Community Environmental Sustainable Mariculture Self Help Group (COMENSUM) initiative was started in 2012 with 20 members. They aimed to eradicate poverty and ensure an adequate food supply through fish farming, crab farming, bee keeping, ecotourism and the rehabilitation of the mangrove forest that was destroyed by human activity. As Diana Wanyonyi reported, COMENSUM planted 128,000 mangrove seedlings across 15 ha of land and is now creating jobs for the local community and contributing to Kenya's AFR100 pledge to restore 5.1 million hectares of degraded land.⁴⁰

By restoring the mangroves, COMENSUM is creating new habitat for the fish, crabs, and other marine life that the community relies on for food and income. According to the Ministry of Agriculture in Mombasa County, the marine fishery sector has the potential to produce 150,000–300,000 metric tonnes of fish annually, but only 9,000 metric tonnes was produced in 2015, compared to Somalia, which produced 132,000 metric tonnes the same year.

6.5.4 The Kenya Coastal Development Project

The Kenya Coastal Development Project (KCDP) developed as an initiative financed by the World Bank and the Global Environmental Facility (GEF) and hosted by the KMFRI.⁴¹ The Bank was supporting local communities and organizations like COMENSUM to expand the region's blue economy as a whole. The KCDP aimed to boost local incomes by supporting the commercialization of fisheries and aquaculture, infrastructure development and training for young people and women. These actions helped the economy of Kenya to grow in a sustainable manner, while also helping to reduce poverty.

6.6 Empowerment and inclusion of coastal communities

Interventions to empower and include coastal communities in development processes have increased across the world.⁴² These interventions seek to address the problems of the poorer coastal communities, who are often at the bottom of the social hierarchy in their nations.

Nearly 50% of coastal communities live below the poverty line, are landless, experience extremely high unemployment levels and depend on irregular employment as part-

⁴⁰ See <https://afr100.org/content/community-kenyas-coast-restores-mangroves-food-security>

⁴¹ For more on this, see Obura (2017b).

⁴² See, for instance, Rajagopalan (2007).

time farm workers or domestic servants, and undertake limited fishing to make ends meet. These communities suffer acute scarcity of clean drinking water and use traditional wood-burning stoves, which are not fuel-efficient, emit smoke and are harmful to health. Further, over the years, widespread cutting of the few existing trees and mangrove forests has led to depletion of the green cover in the coastal areas.

Efforts to empower coastal communities have involved promoting and providing credits to self-help groups, small-scale businesses and vocational training initiatives targeting marginalized groups. For these to fully succeed requires increased capacity tailored to local products and needs, and expanded training opportunities in modern technology. Sports and cultural programmes are also needed to support the youth in coastal communities.

The imperative to integrate environmental conservation and livelihood issues of coastal communities is a critical issue that requires the promotion of ecotechnologies. This also demands measures to increase green cover and promote fuel-efficient stoves, the use of solar energy and rainwater harvesting. Besides increased access to natural resources, initiatives to support coastal communities should be designed to give the poor greater control over their lives and livelihoods. These should enhance the socioeconomic status of the target communities and create awareness of coastal ecology and the importance of preserving the natural environment among the coastal communities.

Finally, it is important in Kenya to integrate the development of coastal communities into the National Spatial Plan to ensure safety and the sustainability of projects in the face of increased the impacts of climate change.⁴³

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⁴³ Rising water levels of Kenya's Rift Valley lakes have flooded properties and displaced communities, most notably around Lakes Baringo and Naivasha and necessitating the need for more holistic longer-term planning in order to secure community livelihoods. See <https://www.bbc.com/news/av/world-africa-27478574>

Chapter 7

Securing the Blue Economy: Maritime Governance and Security in the Western Indian Ocean

7.1 Introduction

This chapter, like others in this volume, synthesizes the views and perspectives that emerged from the presentations and discussions during the Science and Research Symposium. The chapter examines the regulatory framework ideas and structures that underpin the governance of blue economy, as well as maritime security in general.

Maritime governance, or conventionally ocean governance, speaks to the conduct of the policy, actions and affairs to secure and govern the maritime domain, including oceans, seas, lakes, shared rivers and waterways. For a long time, the state has been the dominant actor in policymaking and exercising power in the maritime space. The dynamics of globalization have changed all this. The governance of maritime spaces now incorporates non-state actors such as stakeholders, NGOs and local communities. What makes maritime governance a complex issue is the fact that oceans and the larger maritime domain are part of the global commons that is not owned by any single nation/state. Rather than treat maritime resources as shared heritage and take equal and collective responsibilities in caring for them, humankind has often wantonly abused marine resources. This has created the demand for clear rules and international agreements to regulate the use of maritime resources in a sustainable manner. Besides governance, a maritime security regime is necessary to secure blue economies from piracy, terrorism, pollution and other transnational threats.

This chapter discusses the local, regional and international elements of the emerging governance and security architecture on the sustainable and secure use of marine resources with specific reference to the Western Indian Ocean region. This chapter examines the community-based, regional and international mechanisms highlighted during SBEC 2018, arguing that this regulatory system is still work in progress.

7.2 Community-based regulatory systems

The concept of ‘community-based management’ of ocean resources calls on states to recognize the important role that indigenous and local communities play in sustainable environmental policymaking and how these can be beneficial. It also underlines the partnership between stakeholders and government within the framework of co-management to manage blue economy resources. In light of this, the 2018 Blue Economy Conference in Nairobi drew attention to the diversity and richness of community-based regulatory frameworks across the world. Specifically, the conference highlighted lessons from five examples drawn from across the world.

7.2.1 Community-based fisheries management regimes: lessons from Kenya

The first set of lessons discussed at the conference were derived from the experience of Kenya and East Africa in the management of marine resources. Casting the net wider to cover the pre-colonial experience, experts in the conference used this broad framework to examine present-day fisheries management regimes. Traditionally, coastal and marine fisheries resources contribute significantly to the livelihoods of shoreline communities. Indicative data shows that numerous species have been exploited. This was characterized by multi-gear; from simple lobster sticks to complex driftnets, reef seines, ring nets and long lines.

The development of small-scale fisheries dates back to the nineteenth century. This was closely associated with East African Indian Ocean trade. Before the nineteenth century, coastal Swahili communities, fishing villages and towns emerged and thrived as part of the ‘Swahili Civilization’ in the West Indian Ocean (WIO). There is, however, little documentation of fisheries management along the coast during this period. Formal structures emerged after independence in the 1960s. In Kenya, as elsewhere, fisheries laws have been enacted to better manage fisheries resources. This points to the urgent need to realign coastal and marine fisheries resource management to secure the blue economy and ensure its sustainable exploitation to tackle poverty and create prosperity.

Examples from indigenous information in the Lake Victoria region reveal that there were ‘user rights’ which defined territorial boundaries referred to as *podho* (fishing grounds). *Podho* were demarcated from the village/clan boundary to *kira*, the maximum depth of water in which a stockade trap (*kira*) could be set. The enforcement of the regulations was by clan elders in the Luo Community. Similarly, on the Kenyan coast, there is evidence of clan systems identified with the oldest fishing villages of Vanga, Takaungu, Shela, Faza, Kiwayu and Ishakani. This indigenous management practice was, however, interrupted by factors relating to markets and urbanization.



Kenya's Principal Secretary in the Foreign Affairs Ministry Amb. Macharia Kamau has a word with dignitaries outside the venue of the Sustainable Blue Economy Conference at the Kenyatta International Convention Centre.

Increased market access, urbanization, expanded infrastructure and connectivity increased demand for seafood. In many cases, this engendered the breakdown of community-based governance structures. The decline of community structures and entry of formal governance witnessed a shift from lakeside-community to state-based management of fisheries and others marine resources.

7.2.2 Addressing fisheries conflicts in transboundary waters: the Wangari Mathai Institute

The second set of lessons for regulating the blue economy derives from the work of Wangari Mathai Institute for Peace and Environmental Studies (WMI) in addressing fisheries-related conflicts in transboundary waters of Lake Victoria. The WMI was established in honour of the 2004 Nobel Peace Prize Laureate Professor Wangari Maathai. Located at the College of Agriculture and Veterinary Sciences of the University of Nairobi, the institute's overall aim is to cultivate better environmental stewardship and management of resources and, ultimately, to reduce resource-based conflicts. The major areas of focus of the institution include environmental management of forests and water resources, environmental governance, cultures of peace and cross-cutting issues. Specifically, the institute has ongoing initiatives in the blue economy of Lake Victoria, tackling issues of fishing and conflict on Mgingo Island. The initiative is geared towards ensuring community involvement in improving the collective use of marine resources. The institute is concerned with the need to change the management of resources to address the challenges of this millennium.

7.2.3 Reconciling wetland conservation and livelihoods: University of Eldoret


The third set of lessons was drawn from the University of Eldoret's research on management of wetlands. It was noted that tropical wetlands are the most productive ecosystems in the world. Goods and services that wetlands provide fall into four categories: provisioning, cultural, regulating and supporting. However, unsustainable commercial activities and ineffective protection are eroding natural capital that sustains economic growth. Across many African countries, there has been low valuation of the ecosystem, which poses a challenge of the sustainability of the wetland resources.

The paper highlighted four key threats to the management of wetlands. First, wetlands are fragile and may not bounce back when destroyed. If well managed, they can contribute to the blue economy; but unsustainable exploitation of wetlands can degrade them. Second, gross devaluation of wetlands makes it hard to protect them. Third, there is lack of awareness among many communities around the wetlands regarding the processes and biology behind the degradation of wetlands. As a result, communities overharvest and destroy wetland resources. Finally, climate change and pollution pose major threats to wetlands.

The paper suggested several approaches to the conservation and development of wetlands with community involvement. It called on governments to put in place and enforce strategies to deal with damaging practices that overexploit wetland resources. Second, it suggested the need for strategies formulated to mainstream blue economy in national development agenda. Third, it drew attention to the need to support communities to preserve and maintain the integrity of wetland ecosystems. Fourth, the paper calls on communities to urgently deal with damaging practices and declining resource and ecosystem health issues to achieve the potential of the blue economy. Fifth, it highlighted the necessity of creating awareness in local communities to fully realize the contribution of wetlands to the blue economy. Sixth, it emphasized that national policy on wetlands should be relevant and consider communities. Additionally, it underlined the necessity of creating adequate understanding of the relationship between production and fragility of the ecosystem. Finally, the paper pointed to the need for governments to invest in lifelong education of local communities on the importance of wetlands and their contribution to the blue economy.

7.2.4 Community management of natural resources: the Bahamas–Harvard Project

The fourth set of lessons was drawn from a collaborative project between the Bahamas, Duke University and Harvard University. The presentation was largely on initiatives that have been undertaken to involve communities in the management



of natural resources. From the case of integration of educational outreach in the Bahamas, came the lesson of transfer of skills and knowledge from developed to developing countries. However, the demands of developed and developing countries, such as those of the United States and Bahamas, vary. Developed countries are concerned with maintaining their competitive edge, while developing countries are concerned with the demand for skills in science, technology, engineering and mathematics (STEM), which are important for the blue economy.

The case of the Bahamas–Harvard project highlighted the need to address the specific requirements of developing nations, including improving the standard of living and retaining top talent for their economies. The project provided an opportunity for outreach by connecting students to learning resources. It also helped women to access science, as part of the process of normalizing science as a career path in blue economy. Innovations from developed countries are resource intensive (human, capital and institutional), developing countries (Bahamas) also stress the need for cultural relevance, connectedness to local communities and economies.

The project was designed to integrate science and day-to-day activities of local people in the Bahamas. However, because the project was US based, taking the programme to the Bahamas posed challenges. In regard to physical resources, there was no University of Duke's standard in the Bahamas; no human resources and no funding. The programme also needed to be nationwide and culturally relevant. Furthermore, it needed government buy in.

The project also had its strengths. It was designed to introduce social partnerships, with local partners. Each social partner would contribute to their area of strength with no requirement of funds, hence contributing the needed resources. This was successful in curriculum innovation, exporting knowledge to Duke and Harvard, reaching local students, creating local professionals and creating outreach from the Bahamas college. It also led to the genesis of more programmes.

As a way forward, the paper noted that the blue economy requires STEM skills to be advanced. It also underscored the need for science outreach to find new blue economy opportunities. Clear career profile pathways are needed to tap into blue economy in order to attract young students. Social pathways are needed to enhance the effectiveness of outreach programmes, such as the Bahamas–Harvard project. Further, different countries and research institutions need to collaborate to maximize blue economy potential and to tackle issues of knowledge transfer. African institutions should tap into the commitment from institutions like Harvard and Duke Universities, which have funds for collaborative research on blue economy.

7.2.5 Involvement of Canadian Aborigines in ocean ecosystem management

The final set of lessons emanate from the way the Canadian Government has involved Aborigines in ocean ecosystem management. The Canadian Government has been involved in the protection and exploitation of oceans in order to ensure healthy oceans and livelihoods. To aid this, the government engaged Aborigines in the management of indigenous ocean resources. This helped sustain the original infrastructure of the oceans and protect marine areas, which provide 300,000 jobs. The blue economy approach has been key in reducing the youth unemployment rates in Canada.

The use of wind power from the ocean to create jobs and grow Canada's GDP is one blue economy innovations in the country that illustrates the immense potential of marine ecosystems. Other benefits of the blue economy include fishing, aquaculture, tourism, education, trade, transportation, carbon sequestration and biotechnology.

As a way forward, the paper recommended the creation of a healthy balance between marine life and human activities to ensure sustainable utilization of rivers and oceans. Government and other stakeholders need to address the benefits and challenges of globalization to ensure that it does not undermine poor economies.

7.3 Regional and international regulatory frameworks

This session placed emphasis on the role of ocean governance in achieving sustainable blue economy. One of the key messages was that the regional frameworks governing oceans and other marine domains should operate under UNCLOS and generally be cross sectoral. Ocean governance is fundamental to maintaining ocean health, encouraging the growth of the sustainable blue economy and achieving SDG 14. The oceans are fluid, dimensional, interconnected and constantly changing. This renders governing the 64% of the ocean that lies beyond national jurisdiction, including the high seas, problematic. Challenges to governance include its large size, lack of ownership, dearth of laws that favour appropriate management and difficulty in enforcing such laws.

UNCLOS 1982 and its two implementing agreements, the deep-sea mining agreement and fish stock agreement set out an overarching framework to guide the use and development of the global ocean. UNCLOS does not address burgeoning issues such as regulation of marine biodiversity extraction and conservation in the high seas. Since its inception, the UN Environment Regional Seas programme has promoted regional ocean governance for 17 ocean regions. However, there are many other regional and sub-regional multilateral agreements that must be taken into consideration in building comprehensive regional ocean governance (115 of 158



A section of the VIPs listening attentively at SBEC 2018.

arrangements). Regional integrated ocean governance and institutions need to be strengthened to flexibly adapt to sustainable development. Recent developments in international law against IUU fishing and related crimes at sea has transformed the law on fisheries.

Apart from UNCLOS, many other international institutions have emerged to manage marine activities in the high seas. However, most work done within a single sector leads to inconsistency and lack of communication across sectors, complicating the integrated planning and management of marine resources. Another challenge is the lack of clarity on geographical description/extent and sectoral application of the legal framework. Furthermore, current ocean governance frameworks are plagued by fragmented strategies and overlapping legislation and agreements.

Experts at the Symposium also highlighted the challenge of sectoral and compartmentalized approaches that undermine efforts to create a well-connected, diverse and inclusive blue economy. That is one that is accessible, affordable and attainable by vast majority of humanity. This calls for appropriate regulation for the blue economy to minimize implementation challenges, and increase the speed and effectiveness of regulatory processes. Moreover, it is imperative for governments to ensure that governing institutions at the national level are flexible and, therefore,

increase their ability to adapt rapidly and simultaneously to give long-term support to the environment.

The blue economy can open up opportunities for the integration of innovation, technology transfer and intellectual property in Kenya and the rest of the world. The presentation highlighted the opportunity to engage global conversations through research and studies, such as those of the IOC–UNESCO. These include discussions on an implementation agreement on blue economy under UNCLOS and the opportunity to revisit and review the IMO shipping and maritime transport regime and the FAO fishing regime. Finally, countries need to patent related aquatic technologies, aquaculture geographical indication industries and certification marks as aspects of trademarks to be used to boost the blue economy in coastal communities.

Looking forward, there is need to harness existing international tools to enforce IUU fishing and related crimes at sea. This will require collaboration and coordination in co-governance across all sectors, as well as a global conversation through research on implementation of agreements on blue economy. A review of IMO regime, legal and institutional reforms is also crucial.

7.3.1 The blue economy and SDG 14

One of the main innovations of the SDGs is the inclusion of a stand-alone goal addressing the conservation and the sustainable use of the oceans or waters: SDG 14. This important pillar has spurred numerous global ‘blue’ initiatives, which have focused on the world’s largest habitat. This has given rise to the concept of the ‘blue economy’ or ‘blue growth’ envisaged by the architects of SDG 14. As such, the SBEC drew lessons from the role of regional ocean governance in achieving the blue economy and SDG14.

Obviously, there is not a single definition of ‘regional ocean governance’. Indeed, efforts among multiple countries to work together to conserve and sustainably use their oceans, coasts and marine resources vary widely in scope, mandate and spatial extent. Despite this, regional ocean governance has been proposed as essential for sustainable use of oceans and coastal ecosystems.

A presentation by Robin Mahon of the University of West Indies in Barbados and Lucia Fanning of Dalhousie, Canada, examined the global perspective on regional ocean governance and the implications for both blue economic development, and how to approach the global–regional nexus for ocean governance. They focused on ecosystem-based governance of the ocean.

Regional sea conventions, protocols and action plans are an important part of regional ocean governance. One of these is the Regional Seas Programme which

implements some of the UNEP’s marine-related policies. It also addresses the accelerating degradation of the world’s oceans and coastal areas by engaging neighbouring countries in comprehensive and specific actions to protect their common marine environment. The Regional Seas Programme has helped promote regional ocean governance for 17 ocean regions since its inception.

However, there are many other regional and sub-regional multilateral agreements that need to be considered when building comprehensive regional ocean governance. Some are associated with UN bodies, but there are many ‘indigenous’ agreements developed solely by the countries of the regions. These ‘indigenous’ agreements may be issue-specific or multipurpose economic agreements that include ocean affairs.

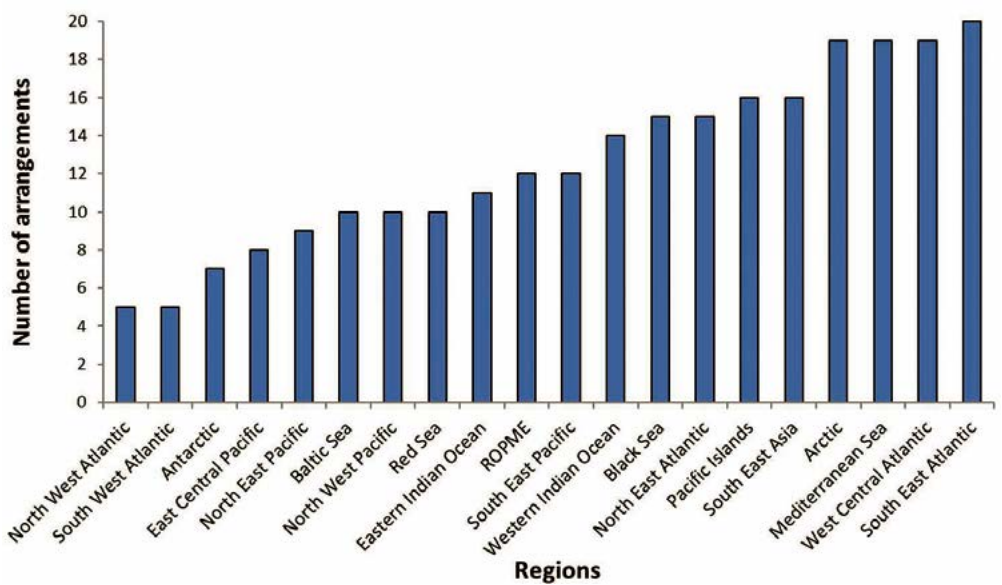



Figure 2: *Number of regional Ocean Governance agreements per region.*

Source: Mahon & Fanning (2018).

Dealing with the entire gamut of regional agreements is challenging for countries and regional organizations for several reasons. The foremost is lack of capacity for engagement. There are few well-developed regional coordination mechanisms to provide the integration needed for ecosystem-based management. Addressing these issues requires understanding the mandates and roles of the full set of organizations and agreements in each region and the options for developing integration mechanisms, which may vary considerably among regions.

The presentation also provided a global perspective on regional agreements in 20 regions of the world, their make-up, complexity, strengths, the extent to which



countries engage with them and the presence of integration mechanisms. It considered the implications of these factors for the way that strengthening regional ocean governance may be approached from global and regional perspectives.

7.4 The governance of the blue economy: lessons from Kenya and Africa

The integration of innovation, technology transfer and intellectual property in Kenya, Africa and globally is crucial for sustainable development, and conservation of the blue economy and aquatic ecosystem.

First, there is a need to clearly identify, conceptualize and problematize resources and the role of the blue economy in sustainable development in Kenya and Africa. This conceptualization should be done within the framework of the UNCLOS. It should also focus on the relevant national, sub-national, regional and international laws on intellectual property, innovation and technology transfer to secure the conservation, sustainable use and sharing of benefits of the blue economy.

Second, Kenya, Africa and the international community should develop, strengthen and integrate intellectual property, innovation and technology transfer law and policy into the blue economy through appropriate technical assistance, partnerships and cooperation.

Third, reforms are needed in Kenya's constitutional, juridical, regulatory, policy, governance and administrative frameworks to implement and enforce intellectual property, innovation and technology transfer for sustainable development of the blue economy. Recommendations conclusions need to be made based on research objectives, research questions and arguments on the role of intellectual property, innovation and transfer technology in the blue economy of Africa.

7.5 Towards an inclusive blue economy regime

The need for an inclusive global blue/ocean economy regime cannot be denied. There is heightened interest among states and regions in the spaces and resources of the oceans and seas. Further, there is a greater awareness of their potential to meet increasing demands for goods and services for humankind for the present and the future.

The concept of blue economy has been thrust into the global limelight. However, the concept remains rather fluid and imprecise. Further, the rules of engagement among states, regions and other stakeholders remain unclear and rather problematic. This situation extends to crucial aspects, including decision-making, accountability and governance. In this regard, two key deficiencies in the prevailing regime were discussed. The first was lack of inclusivity, particularly

for developing states and regions and their non-state stakeholders. The second was the apparent inadequacy of global instruments and regimes underpinned by the 1982 UNCLOS to address emerging challenges of the blue economy. A more inclusive regime among states and regions is needed. To achieve this, a viable option could be the establishment of a global framework that promotes equity, inclusion and sustainability.

7.6 The exceptionalism of blue economy in Africa

Experts at the Symposium pointed to the exceptionalism of the blue economy in Africa. It is important to note that all great nations and civilizations throughout history are located by the sea, from Roman Empire to modern day China. These nations rose to greatness because they exploited the sea and the opportunities therein. However, it seems African countries by the sea are an exception. This presentation explored this exceptionalism by selecting a number of African countries and comparing them with a few great countries next to the sea from different parts of the world. This analysis was aimed at informing Kenya's policy makers and investors in making blue economy one of the contributors to Kenya's GDP.

7.7 International law against illicit fishing

Experts drew lessons on recent developments in international law against IUU fishing and related crimes at sea. IUU fishing has become a global challenge and one of the main obstacles to the sustainable management of fish stocks. IUU fishing has changed and extended in parallel with globalization and the trade of natural resources, at the heart of the current sustainable development.

This is one of the activities of SDG 14.4: 'by 2020, effectively regulate harvesting and end overfishing, IUU fishing and destructive fishing practices'. The presentation briefly reviewed the developments in international fisheries law since it recognized IUU fishing as a legal issue that must be addressed. Fisheries law must continue to transform itself to improve its ability to eradicate this problem, beyond its current parameters.

The blue economy, a concept that is much broader than just the issue of overexploited fisheries, shows that IUU fishing interacts transnationally with other infringements and unauthorized behaviours, called 'serious offences' or 'fisheries-related crimes', such as human trafficking, forced labour, corruption, tax fraud, trafficking in other illegal substances and sometimes financing terrorism. The use of rights other than fisheries law, such as environmental law, trade law, maritime law and fiscal law is essential to closing the net on IUU fishing.



Ms. Toral Vagdama, Programme Officer from UNODC presents a case study on Global Maritime Crime at the University of Nairobi Taifa Hall.

The purpose of this presentation was to show the most significant developments in international and national laws that can have a substantial impact on tackling IUU fishing practices. This shows how national fisheries regulatory frameworks, supported by the work of regional fisheries management organizations, or other agencies, could become stronger in the future and help build a 'legal blue economy', which is crucial for economies to be sustainable.'

7.8 Maritime security

The participants in the panel on maritime security came from local and international sectors that included international research institutions, government institutions, private organizations, local organizations, the media and universities. The experts highlighted the need for a stable and secure environment as a pre-condition for sustainable exploitation of the blue economy. They also stressed the need for evidence-based research and knowledge in securing navigation routes, generating useful oceanographic data for marine industries and protecting rights over valuable marine resources.

Current approaches to dealing with piracy and maritime offences are not effective in tackling the new trends and threats. This is because of intrinsic definitional problems in treaties that then lead to practical challenges in their application. Current laws defining piracy and maritime offences need to be amended. The evolving nature of maritime security threats is an increasing concern, especially among littoral states.⁴⁴

Greater focus is needed on a framework to establish a more collaborative, proactive and adaptable enforcement system of maritime security. A cost-effective approach towards maritime safety and security calls for an efficient use of resources, that is complementarity of assets, does not duplicate tasks, shares information and coordinates cross-sectorally, without overlapping sectoral responsibilities.

7.9 The French concept of 'state action at sea'


The French organization State activités at Sea combines expertise and resources to enable state action at sea anywhere, at any time. Using the full range of civilian and military capabilities, France acts at the earliest possible time and as far as possible from the shores to ensure enhanced effectiveness and action, covering a whole range of missions.

The panel drew attention to three challenges to sustainable marine security. The first is the lack of a more proactive and functional multilateral approach towards maritime safety and security. Second is the lack of trust and confidence needed to create an enabling environment where all parties can share intelligence and other information willingly. Finally, less functional legal frameworks, policies and treaties have led to practical challenges in their application or implementation.

But there are also opportunities. First, there is a need for a review of existing international maritime frameworks, policies and law and more collaborative efforts in enforcement and prosecution of maritime crimes. There is also a need for standardized training and capacity building on aspects of maritime safety and security. Finally, there is need to strengthen existing international collaborations in maritime safety and security enforcement efforts.

To progress, a focus on building a functional multilateral enforcement approach is needed. There are lessons to be learnt on multiple risks and threats at sea (piracy, trafficking, illegal fishing, illegal seaborne immigration). This presentation highlighted an increase in maritime traffic and accidents at sea. There are also tense relationships between neighbouring countries. There is need for environmental sensitivity (need of protection and oil spill response capabilities). Finally, the

44 States located near to the shore of the sea or a lake.



presentation suggested that effective coordination of maritime security is vital and can be best achieved through pooling of resources with a focus on adapting to new security challenges.

References

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SECTION 3

Beyond SBEC 2018 and the Road Ahead

Chapter 8

How the 2018 Sustainable Blue Economy Conference Catalysed a Range of National, Regional and Global Initiatives

8.1 The trigger effect of SBEC 2018

One of the major outcomes of SBEC 2018 is that it triggered a diverse range of national, continental and even global-level initiatives aimed at harnessing the dividends of the blue economy. Several initiatives underway or being contemplated are in line with what SBEC 2018 projected as, ‘the productivity and sustainability’ pillars of the blue economy.⁴⁵ This chapter provides a brief overview of some of these initiatives that are likely to have significant impacts in the near- to long-term future.

The initiatives highlighted here should, essentially, provide a starting point for follow-ups on how UN Member States, particularly developing countries, are putting measures and resources in place to maximize benefits from the blue economy. Further, the initiatives ensure the protection and sustainable use of blue economy resources in line with the principle of inter- and intragenerational equity. The focus of this chapter is therefore on the promise presented by an Africa Blue Economy Strategy. This was developed by the AU Commission to guide implementation by AU Member States and continental agencies, such as the African Development Bank (AfDB). The chapter also reviews some of the national initiatives that are being pursued by the Government of Kenya as part of its commitment to the blue economy. Lastly, it indicates the global direction of the blue economy as countries prepare to re-converge in Lisbon, Portugal, for the UN Oceans Conference.

⁴⁵ See SBEC (2018) for the overarching conference theme and focus.



Kenya's Principal Secretary, State Department for Shipping and Maritime in the Ministry of Transport, Infrastructure, Housing, Urban Development and Public Works Mrs. Nancy Karigithu with Dr Cleopatra Doumbia- Henry, President of World Maritime University, Sweden.

8.2 The length and breadth of Africa's blue economy

Africa's blue economy encompasses a variety of lakes, rivers and a wide ocean resource base that covers about 47,000 km of coastline. Of the 54 African states, 38 are coastal and island states with more than a quarter of Africa's population living within 100 km of the coast. This, together with rapid population growth and urbanization, amplifies the pressure on marine resources. Within Africa's jurisdiction, there are maritime zones comprising about 13 million square kilometres of collaborative EEZs across states, with approximately 6.5 million square kilometres of continental shelf. In the near future, it is anticipated that the majority of mineral resources will not be found in terrestrial ecosystems but rather in the sea.

Maritime transportation serves as the main form of world trade, while also being the cheapest means of bulk transit as approximately: 90% of all items are moved through this route. The scope of Africa's blue economy transverses different productive sectors, including aquaculture, tourism, fisheries, energy, shipping, underwater mining and bioprospecting, in addition to other allied activities. The concept of the blue economy in Africa, therefore, logically emanates from the need to sustainably manage water bodies. With increasing intensive economic utilization of oceans and seas, together with the impact of climate variability and change, come the exhaustion of marine ecosystems. The global climate change challenge manifests itself in the associated rise in sea levels and temperatures,

thereby posing significant social, economic and ecological risks. In terms of ocean governance, within the jurisdiction of different countries, there are also policy and practice gaps and transboundary collective actions in the management of aquatic resources with spill-over effects. This, consequently, affects the blue economy in Africa. Last, but not least, is the challenge of resources, both in terms of finances and skilled human resources.

8.3 Some notable African blue economy frameworks currently in place

At present, there are continent-wide frameworks that inform the sustainable management of Africa's blue economy resources. The frameworks include the AU Agenda 2063, which elucidates in its sixth goal: 'accelerated economic growth, with highlights on the priority areas such as marine resources, energy, port resources and maritime transport'. The other is AIMS 2050, which aims to foster an increased creation of wealth from Africa's water bodies by developing a sustainable blue economy. The African approach is characterized by a strategic governance framework that is integrated with a combined African EEZ. The African Charter on Maritime Security and Development (Lomé Charter) 2016 calls for continent-wide collective action to enhance marine protection and security. As elaborated below, the AU Commission and the AfDB have moved further to implement actions based on the recommendations of SBEC.

8.3.1 The AU's African Blue Economy Strategy

*The majority of new mineral resources will not be found on land but in the sea.
There is no food security without a sustainable ocean.*

President Danny Faure of Seychelles

During SBEC 2018, African leaders at the conference directed the AU to work with relevant stakeholders to develop a blueprint for Africa's Blue Economy Strategy that will guide sustainable development and utilization of resources of the oceans, seas, lakes and rivers for blue economy growth and livelihoods. The AU Commission, through its technical agency, the AU-Inter-African Bureau for Animal Resources (AU-IBAR) led the formulation of the Africa Blue Economy Strategy, which was endorsed in October 2019 by the AU Specialized Technical Committee on Agriculture, Rural Development, Water and Environment (AU-IBAR, 2019). The Africa Blue Economy Strategy is focused on five thematic areas considered critical to the Africa blue economy growth:

- fisheries, aquaculture, conservation and sustainable aquatic ecosystems;
- shipping/transportation, trade, ports, maritime security, safety and enforcement;

- coastal and maritime tourism, climate change, resilience, environment, infrastructure
- sustainable energy and mineral resources and innovative industries;
- policies, institutional and governance, employment, job creation and poverty eradication, innovative financing.

Since the adoption of the Africa Blue Economy Strategy, the AU-IBAR has continued with its implementation and developed an implementation plan for the period 2020–2025 (AU-IBAR, 2020). Through the support of Norway, the agency is providing technical assistance to ten selected AU Member States (Burkina Faso, Central African Republic, Federal Republic of Somalia, Libyan Arab Republic, Mali, Niger, Republic of the Congo, Sudan, South Sudan and Zimbabwe) and three selected Regional Economic Communities (East African Community (EAC), Common Market for Eastern and Southern Africa and Economic Community of Central African States). It is supporting them in formulating their national and regional blue economy strategies, implementation plans and corresponding frameworks for setting up blue governance mechanisms.

8.3.2 Integrating the blue economy into the AfDB Frameworks

At SBEC 2018, the AfDB prepared a Briefing Note for the Blue Economy Flagship to implement the Feed Africa strategy into fisheries and aquaculture. This will be implemented in close partnership with other natural resource sectors and stakeholders. The Flagship revolves around three major components:

- reducing post-harvest loss through fish commodity value chains, access to markets and local consumption;
- integrating watershed management and MSP to reconcile multiple coastal demands, protect critical habitats, and to promote the resilience of coastal populations;
- fostering regional governance mechanisms through partnership and programme coordination, monitoring, learning and evaluation for scaling out.

The AfDB, in partnership with the World Bank and the FAO, established the African package to support climate-resilient ocean economies in 29 African coastal and island states. An investment of US\$3.5 million has been set aside for use in different sectors, coastal protection, harnessing of ocean energy, fisheries and aquaculture, tourism, transportation and trade. The African Natural Resources Centre of the AfDB is developing a Blue Economy Strategy Implementation Plan which focuses on six key pillars. These are Blue Ports, Blue Energy, Fisheries and Aquaculture, Blue


Biotechnology, Maritime and Coastal Ecotourism, and Marine Extractives. Within each of these pillars, the Centre plans to support countries by providing analytical and advisory support, financial and resource mobilization, and technical assistance, while also building capacities in the respective countries.

The AfDB's Blue Economy Strategy Implementation Plan for Africa is designed to contribute to the Bank's five priority areas (High 5s): Light and Power Africa; Feed Africa; Industrialise Africa; Integrate Africa; and Improve the quality of life for Africans. These five priority areas also fall within the ambitions of the SDGs, the AU 2063 Agenda and various country national development goals. Certain countries in Africa have made progress with initiatives aimed at creating sustainable blue economies through advancements within their national plans. Examples include South Africa's Operation Phakisa, which promotes development within the maritime transport and manufacturing sectors, aquaculture and marine protection with improved ocean governance. Mauritius, on the other hand, has created their National Ocean Council within the Blue Economy Ministry that sets a precedence for a Blue Economy Roadmap in the country. This is geared towards marine energy, fisheries, technological advancements in maritime ports, sustainable aquaculture, creation of a seafood hub and efficient management of lagoon ecosystems. Seychelles has a comprehensive Blue Economy Roadmap, begun in 2018, to forecast 'blue growth' until 2030. It aims at MSP covering approximately 16% of the country's maritime domain and at creating blue economy financing. The AfDB has signed an U\$800,000 grant agreement with the Government of Seychelles to support micro, small and medium enterprises (MSMEs) in its blue economy sector. The package will help Seychelles to develop its marine biotechnology sector, strengthen the capacity of public institutions and private operators, create a knowledge platform on emerging business opportunities, and provide technical and financial training to MSMEs.

8.4 Some initiatives undertaken by the Government of Kenya

Since the successful hosting of SBEC 2018, the Government of Kenya has spearheaded several initiatives. It started with the a fully-fledged State Department of Fisheries, Aquaculture and the Blue Economy established by Executive Order No. 1 of 2018 (Revised May 2020). This was the first signal of commitment to tapping into the potential of the blue economy. This was complemented by the establishment of a Blue Economy Implementation Standing Committee within the presidency and headed by the Chief of the General Staff of Kenya's Defence Forces.⁴⁶ Membership of the Blue Economy Implementation Committee was drawn

⁴⁶ See Official Gazette establishing the Blue Economy Implementation Standing Committee: CXIX-No 76, Gazette Notice No: 6275 of 29th June 2018. It is understood that the implementation committee has since been converted to The Ocean and Blue Economy Office (TOBEO)




from key sectors of the blue economy in Kenya. One of the signature outcomes of this arrangement has been the quick turn-around in implementing priority activities sanctioned and prioritized directly by the presidency. Thus, Kenya was among the first nations to establish a multi-agency Coast Guard Service in its part of the Indian Ocean, partly to enhance its maritime security and, no doubt, to secure Kenya's coastline and the continental shelf.

Kenya has also made some progress in ensuring responsible and sustainable fishing for the conservation of endangered and high value fish stocks. This includes monitoring and surveillance of its blue spaces to ensure compliance with fisheries legislative and regulatory frameworks aimed at deterring IUU fishing as regulated by the FAO Port State Measures Agreement and, locally, by the Fisheries Management and Development Act No. 35 of 2016 and the Kenya Coast Guard Service Act No. 11 of 2018.

The State Department of Fisheries and the Blue Economy continues to be an active voice regionally and globally towards the promotion of sustainable and responsible fishing. Thus, the department participated in hosting the 68th International Whaling Commission Scientific Committee that drew about 130 cetacean scientists. Kenya is also the current serving Chair of the Indian Ocean Tuna Commission. The country was also re-elected as Chair of the Executive Council of the IOC–UNESCO. As part of the country's ocean literacy initiative, Kenya has rolled out sensitization and capacity-building programmes for young learners in schools and communities. The programme has two objectives. The first is to raise awareness of the young population on the tenets of blue economy, its importance and opportunities. The second is to enhance the understanding and participation of the learners in the conservation and sustainable utilization of the blue economy resources.

Additionally, the department, in partnership with relevant government partners has embarked on the development of an MSP that facilitates a coordinated and sustainable approach for adaptive, precautionary and ecosystem-based management. The UNDP/ UNEP Western Indian Ocean Large Marine Ecosystems Strategic Action Programme for Policy Harmonization and Institutional Reforms has also been renewed. This which aims to achieve long-term ecosystem management in the WIO with implementation being undertaken by nine WIO states, Kenya being one of them.

In support of harnessing the economic potential and opportunities in shipping, the Government of Kenya established its first training facility at the coast, exclusively for seafarers at Bandari College. This development is likely to enhance a process of certification for Kenyan seafarers, and could serve the entire Eastern Africa region and providing the staff needed in the shipping industry. Its trigger impact is in employment and job creation and so is a major impetus, given the crisis of



youth unemployment. Discussions are also underway to finalize the establishment of the Institute of Blue Economy and Ocean Studies at the University of Nairobi. If successfully established, it will be a major research, training and capacity-building centre that will focus on advanced training to provide the skills and human capacities required for operations and the shipping industry, more generally, in Kenya and the rest of Africa.

In terms of enhancing marine transport, Kenya has moved to establish an inland dry port in the town of Naivasha. This will handle cargo while also creating employment around Nairobi, with the spill-over consequence of saving the country's roads from overuse and damage during cargo transportation, which has been a major challenge in the past. The dry port in Naivasha also links with the Standard Gauge Railway and hence to the Indian Ocean, enhancing global commerce, transportation and connectivity. These initiatives have further augmented the country's efforts to develop Northern Corridor projects that include a major port at Lamu and associated complementary infrastructure along this corridor. Further down, the Government of Kenya has finalized the revitalization and re-opening of the long-moribund inland port of Kisumu which is a key eastern African regional hub for trade and commerce. Kisumu Port will kick-start trading activities between the five eastern African nations of Kenya, Burundi, Rwanda, Tanzania and Uganda, and is likely to strengthen the economic and commercial opportunities of riparian communities around the Lake Victoria region.

In fulfilling its commitment to accelerate the development of marine and inland fishery industries by increasing aquaculture, fish processing and storage capacities related to blue economy industries, Kenya has made additional advancements. Preparations are presently at advanced stages for the implementation of the Kenya Marine Fisheries and Socioeconomic Development Project that is to run in the five coastal counties of Tana River, Lamu, Mombasa, Kilifi and Kwale. The project aims to improve the management of priority fisheries and mariculture, while strengthening coastal livelihoods. The Aquaculture Business Development Programme was launched in 2019. Its prime objective is to accelerate the income of households involved in aquaculture-related activities in 15 targeted counties, with improved food security and nutritional status of local communities. The Government of Kenya has rehabilitated and operationalized the Shimoni Jetty in Kwale County in compliance with required fish handling, marketing, monitoring, control and surveillance activities. Other landing sites developed include six in Lake Victoria and five along the Kenyan coast. Two markets in Malindi and Mombasa counties are targeted for renovation and kick-starting operations. Furthermore, the government continues to build the capacity of local fishermen and has procured three fishing vessels for them in Lamu County. As a directive from the presidency,

the process of recovering gazetted landing sites in partnership with the National Land Commission is in progress. It is targeting 26 landing sites along the coast of Kenya, while 12 on Lake Victoria are earmarked for recovery and development. The Government of Kenya has agreed to collaborate with the Government of Namibia on marine resources management, with a focus on making the country's fisheries more professional for the benefit of citizens and the economy.


A partnership with the Kenya Red Cross aims to revitalize the Kibuyuni seaweed industry in Kwale County. There are discussions between the Government of Kenya, the Ocean Foundation and the Government of Canada to establish marine aquariums in Kenya for public education and research. As a stimulus for economic growth for sustainable utilization of blue spaces and for job creation, the Government of Kenya has gazetted Liwatoni fishing port in Mombasa County. Renovations are in place to revitalize the port into a modern facility that serves several purposes, such as anchorage, security, cold storage and fish handling, fish auction, transshipment, marketing, and other auxiliary services. Upon completion, this port is envisaged to be a leading marine fisheries hub on the East African coast and in the Western Indian Ocean region.

Lastly, the Government of Kenya is committed to establishing a blue economy bank to support growth and development in the blue economy sector. It aims to achieve this by working on proposed incentives for the fisheries sector with an objective of seeing the revival and productivity of primary, secondary and auxiliary services to investors in the blue economy. These are subject to approval from the EAC and Kenya's National Assembly for legislating and operationalizing the incentives.

8.5 Blue economy in the global agenda

The ocean serves as the largest continuous connected water system covering a range of different ecosystems, ranging from nearshore coastal environments to large marine environments, far from national delimitation. Many oceans and coastal nations globally, including SIDS and those within the European Union, are active in promoting blue economic growth (GEF, 2018)⁴⁷. However, the growth of the blue economy sector as a new economic frontier is marred with certain challenges that have a long-lasting impact to society and the globe. These include increased demand for marine resources, overfishing, climate variability and ocean acidification, advancements in deep-sea exploration, pollution and habitat fragmentation, coupled with noncompliance, and regulations that are cumulative in causing irreversible damage to ocean ecosystems.

47 For this and other references to the Green Environment Facility (GEF, 2018), See: https://www.thegef.org/sites/default/files/publications/GEF%20Assembly_BlueEconomy%20Factsheet_9.4.18_0.pdf



The UN Agreement on the 2030 Agenda for Sustainable Development has a sole goal 14 that provides a framework to sustainably conserve and use oceans, seas, and the marine resources. The GEF aims to establish robust national blue economy opportunities in recipient countries by financing regional and national initiatives that address pressures on land-based pollution, overfishing and habitat loss of key coastal and marine ecosystems (GEF, 2018). Countries are working on drafting visions for a sustainable ocean economy that balances growth and sustainability for ideal use with maximum benefit and minimal environmental risk. These ambitions are supported by blue economy plans within the maritime jurisdiction of each country. The visions are further strengthened by the provisions in UNCLOS that offer legal validity of maritime rights and obligations of states. Different countries draw different perspectives on the blue economy agenda with varied allied activities. For instance, Australia launched the Blue Well-Being initiative that recognizes ocean-based industrial development and growth, as blue GDP is crucial to the country's economic and social development. Australia prioritizes the blue economy to promote maritime industry development that has economical, ecological and social benefits, while adhering to an ecosystem-based model for decision-making within industry and for community wellbeing.

The 54 Commonwealth countries have an agreement known as the Blue Charter through which Member States collectively cooperate in addressing ocean-related problems and aim to meet the global commitment to the sustainable development of oceans. The objectives of the charter are achieved through a series of action groups, each dedicated to a given ocean issue. These action groups are driven by member countries, guided by champion countries on the given thematic ocean issues. This chapter highlights some global case study action group projects that indicate the best-practice success stories and experiences.

Cyprus provides a good illustration of aquaculture development, as highlighted in the experiences shared through the Commonwealth Blue Charter Case Study (Commonwealth Secretariat, 2020a). Aquaculture development in Cyprus dates back to the late 1960s, which saw the establishment of a freshwater aquaculture research station and the development of privatized freshwater fish farms. Prior aquaculture development in the country was in part covered by fisheries legislation, but the increased interest of the private sector in marine aquaculture in the early 1990s necessitated a definite aquaculture policy that led to an applicable legislative framework. This current framework, which was strengthened by enforced regulations in 2000 and 2002, serves as a basis to promote and support the development of an environmentally suited, financially feasible and socially accepted aquaculture sector in Cyprus. Development of the aquaculture sector in the country is aided by the environmental footprint and impacts associated with offshore aquaculture activities; these are critical in

paving for the development of the marine aquaculture sector as informed by necessary legislation. Presently, Cyprus has nine licensed marine offshore aquaculture units. The sector is the country's third most important export from primary agricultural production, contributing about €27 million (approximately US\$31,659,930) in annual value (Commonwealth Secretariat, 2020a).

Seychelles is another country that has shown marked progress in the development of the blue economy sectors (Commonwealth Secretariat, 2020b). The fisheries sector is estimated to contribute US\$400 million to the national GDP, with the per capita level of fish consumption double the global average. Notwithstanding this, progress in the country's aquacultural sector has been slow. This led to a shift in 2018, with a new focus on reviving the mariculture industry through adoption a Blue Economy Strategic Framework and Roadmap. Coordinated efforts by the Seychelles Fishing Authority, in line with the UN FAO Ecosystem Approach to Aquaculture, have seen the development of marine finfish and marine invertebrate farms. In the past 10 years, a baseline has been established for ongoing work, such as the preparation a Mariculture Master Plan and the development of a regulatory framework. Further feasibility and zoning studies have included an environmental and social impact assessment, which was conducted in 2016. The zoning approach identifies best-practice areas for aquaculture production through use of artisanal and commercial systems, the latter being covered by the Fishing Authority, as well as commercial zones that necessitate distinct impact assessments. Enforced legislation has created mandatory aquaculture standards that are supported by well-conducted market research. Key infrastructure developed includes a quarantine and brood stock facility in the province of Mahe. This is a priority to decrease the risk of disease transfer and the escape of exotic species as the country relies on indigenous species. The same province has established a sea urchin research facility, while also having a pilot-scale cage aquaculture site in place.

Aquaculture regulations are being improved. The Seychelles Fishing Authority is building stakeholder capacity through public education and awareness campaigns, which local and international investors have indicated vested interest in. Thus, blue economy initiatives create an avenue that prioritizes sustainable aquaculture as a key driver towards the diversification of ocean-related activities. Consequently, aquaculture is foreseen as having the capacity to set new economic standards for society (Commonwealth Secretariat, 2020b).

In December 2018, the Norwegian Prime Minister Erna Solberg launched the High-Level Panel for a Sustainable Ocean Economy. The panel comprises 14 Heads of state from the coastal states of Australia, Chile, Fiji, Ghana, Indonesia, Jamaica, Japan, Kenya, Mexico, Namibia, Norway, Canada, Palau and Portugal, as well as the UN Secretary General. The following actions have been prioritized:

- actions to help achieve SDG 14.4 that commit states to ending IUU fishing and overfishing by 2020;
- SDG 14.6 in which states commit to prohibit harmful forms of fisheries subsidies by 2020; and,
- ocean-based climate action, given the strong linkage between climate change and the ocean.

The panel is unique in that it is the only ocean-related initiative that is anchored in science and driven by political leaders at the highest level. The panel charts a new policy-driven course for sustainable exploitation of the ocean that will enable countries to produce and prosper in an equitable way. The Ocean Panel launched the new Ocean Action Agenda in December 2020. It is built upon knowledge and science, transformative recommendations and action.⁴⁸

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⁴⁸ Additional information on the Ocean Panel is available at www.oceanpanel.org/

Chapter 9

Prospects for Advancing the Promise of the Blue Economy

9.1 Overview and introduction

SBEC 2018 was billed as the first-ever, Global Sustainable Blue Economy Conference. The Government of Kenya was joined in this initiative by the Government of Canada as ‘co-host’, and a little later by the Government of Japan, who provided a generous donation of US\$3 million. These contributions were to help Kenya (a developing country) organize and host the conference. More than a dozen other countries, and some private sector actors, stepped in as sponsors of the conference and contributed varying amounts of financial support,⁴⁹ leading to a successful conference.⁵⁰

Overall, as we have seen throughout this publication, the SBEC 2018 focused on the ‘sustainability and productivity’ pillars of ‘the blue economy’ and sought to move global attention beyond the previous, albeit-scattered, focus on oceans.⁵¹ This renewed focus, led by Kenya, was directed not just towards oceans, but to inland waters, particularly lakes and rivers, which were largely neglected in previous ocean conferences. In this way, SBEC 2018 was arguably the first global effort to shift global attention to what is fast gaining traction as a distinct water-based economic resource, separate and apart from orthodox and largely, land-based economic resources. The ‘blue economy’ on its own merit, must therefore also be responsibly harnessed for sustainable development.

This concluding chapter is largely motivated by the realization that the traditional conference has a way of disappearing along with important lessons, especially once the momentum dies. Worse still, if the conference was only perceived and planned as a single event the critical long-term vision or agenda can be lost. Indeed, where no deliberate mechanisms are put in place to ensure follow-up and implementation, it is likely that initiatives as such SBEC 2018 could quickly disappear from the radar as people return to day-to-day business. Yet, even where structures and institutions have been formulated in one way or the other, there

49 The full list of host, co-host and sponsors is accessible at <http://www.blueeconomyconference.go.ke/partners/>

50 This assessment is, of course, purely anecdotal and largely based on internal perceptions by those who were at the centre of organizing the SBEC.

51 Most earlier conferences were exclusively ‘ocean conferences’ and in this way ignored the large pool of inland water resources



HE President Uhuru Kenyatta engages exhibitors at the exhibition tent of SBEC 2018.

remains a strong case for a more solid and enduring arrangement that can carry forward the thinking and the vision behind a sustainable blue economy. In the immediate aftermath of SBEC 2018, many events could have delayed the promises and the commitments made at the conference, none of which in our view, has been as significant as the sudden eruption of the COVID-19 pandemic. Beginning at the end of 2019, this outbreak rendered the next year (and still counting) probably the most wasted and uncertain period of the entire century.

Assuming, of course, that normality must return in one form or another, this chapter aims to provide a brief review and critique of the Nairobi SBEC conference programme and its outcomes. It will discuss recommendations that can help Kenya and the global community advance what we categorically call the ‘promise of the blue economy’ within the present-day context of ‘Sustainable Development and the Agenda 2030 goals’.⁵² A secondary objective of this chapter is to highlight for the scholarly and policy communities some key lessons and experiences derived from being closely involved with SBEC, and other global conferences. Further, we offer suggestions on just how to adapt the global conference landscape in response to a highly digitized and much changed global community.

9.2 Blue economy: myth or reality?

To begin with, we must first revisit the contested concept of the blue economy. This is against a background in which legitimate questions have been raised regarding the validity of yet-another puzzling buzz word and categorization. During the preparatory stages for SBEC, representatives from Kenya’s own business and

⁵² The 17 SDGs and their 160 plus indicators are the present-day global pact, agreed by the community of Nations during the UN general assembly in September 2015, picking as they were from the earlier Millennium Development goals whose term ended in 2015.

private sector community, the Kenya Private Sector Alliance, called on Permanent Secretary, Ambassador Macharia Kamau. They requested that Kenya's Ministry of Foreign Affairs (MFA), who were charged with the responsibility of organizing the conference, provide a simple write-up that could explain what 'blue economy' is. It immediately dawned on us as policy mandarins in the Ministry, that the blue economy, as a concept, was not obvious to everyone, and, even more so, to sectors of the economy that were expected to embrace it. Our one-page idea (reproduced below⁵³) was the outcome of that private sector entreat and indeed, one of the MFA's attempts to demystify or define the blue economy in a manner that could speak to the business community. It was, however, Uganda's President H.E Yoweri Museveni, who in his presentation at SBEC caused a real furore when he berated two of the leading advocates of the blue economy (Pavan Sukhdev and Justin Mundy⁵⁴) 'to stop confusing people'. In his off-the-cuff address to delegates gathered at the Kenyatta International Convention Centre Tsavo Hall, President Museveni stated categorically that he only came to SBEC after his own in-depth research and reading. He finally realized that the 'mumbo-jumbo' that had befuddled him as blue economy, was no more than a simple discussion of 'life'. The Ugandan president, therefore, wondered, much to the amusement of the assembled delegates, why the two 'experts' were calling such an obvious thing as 'life' by the strange name 'blue economy'. Whether or not President Museveni was right is beside the point here. The fact is that the concept of the blue economy – at least at the time of writing – still solicits more questions than answers, even from people who, in a sense, would be considered its 'experts'.⁵⁵

Historically, however, the blue economy cannot be said to be necessarily a reference to something new, or an expression that had never been heard of before. Indeed, the available documentation did show that the concept was first used and promoted by the SIDS in the context of oceans, recognizing as they rightly did that the livelihoods of those in the SIDS depended entirely on the ocean waters. Instructively, no international consensus was reached or adopted over the use of the concept (SBEC, 2018). The United Nations Economic Commission for Africa (UNECA) published some early pieces that attempted to demystify blue economy and, happily, embraced the broader and more inclusive notion of the concept: 'The blue economy covers all bodies of water, including lakes and rivers, in addition to oceans and the coast. The main sectors are fisheries, aquaculture, tourism, transport, ports, energy and mining with many links to others in the economy' (UNECA, 2016: 32).

53 We acknowledge here the 'unpacking' contribution of officers from the MFA's Department of Economic Diplomacy and Multilateral Trade, notably Sospeter Ngoya and Johnson Weru. For the graphic rendition, we are indebted to Amollo Ambole of the University of Nairobi's School of Design.

54 President of WWF and Special Envoy for Conflict and Natural Resource, World Resources Institute, respectively.

55 Given the wide range of specialisms that ultimately define the blue economy, our view is that the expert idea is a misnomer, or rather, must be seen to refer to the amalgam of applicable disciplines, often difficult to find in just one individual.

What is the Blue Economy?

Oceans, Lakes, Seas and Rivers contribute to poverty eradication by creating sustainable livelihoods and decent work. They also provide food and minerals, generate oxygen, absorb greenhouse gases and mitigate the impacts of climate change. In addition, they determine weather patterns and temperatures and they also serve as highways for seaborne international trade.

The blue economy is a concept derived from all these. It seeks to promote economic growth, encourage social inclusion, improve livelihoods while also ensuring environmental sustainability. The Blue Economy has diverse components, including established traditional ocean industries such as fisheries, tourism and maritime transport, but also new and emerging activities, such as offshore renewable energy, aquaculture, seabed extractive activities, and marine biotechnology.

A number of services provided by ocean ecosystems include carbon sequestration, waste disposal and the existence of biodiversity.

Benefits of Sustainable Blue Economy Conference (SBEC) to Kenyans

The participation of the Private Sector in the Blue Economy Conference (SBEC) scheduled for 26-28 November, 2018 in Nairobi will accrue a number of benefits including:

- The creation of strategic partnerships and expanding of networks through various Business-to-Business networking sessions and Business-to-Government sessions;
- The creation of visibility for corporate brands through participation and sponsorship of events;
- The identification of opportunities in the Blue Economy Sector as a means of diversification of businesses;
- The exploration of the potential of Blue Economy in promoting medium and small-scale enterprises;
- The sale and increased usage of products and services by conference participants; and
- The opportunity to influence government and international policies on investments in the Blue Economy sector.

Figure 3: Ministry of Foreign Affairs, Republic of Kenya's depiction of 'blue economy'

It is our view that it was part of SBEC's mission to further operationalize blue economy as a distinct and evolving concept and to link it more directly to industrial and commercial productivity. This, in turn, puts it not only as an economy in its own right, but rather at the apex of the global quest for sustainable development. The Nairobi notion of the blue economy therefore saw beyond oceans, lakes and rivers, and quite critically emphasized productivity aspects. Figure 11 presents our attempt at unpacking the blue economy. This refers specifically to the huge collaterals from blue economy including:

- shipping and transportation;
- job creation and poverty alleviation;
- health, pharmaceutical and dietary benefits derived largely from fisheries and the largely unexplored marine ecosystems;
- tourism by coastal states;
- women and youth occupations around various aspects of the blue economy;
- climate change and the sequestration role played by water bodies and the diverse BCEs (Chapter 4) in the general mitigation of climate change, and many more.

As we explain below, Nairobi also recognized the imperilled status of global water resources. Further, it highlighted that all talk around sustainable development in the context of the SDGs would remain moot if the global community did not rise to the occasion and redefine how water resources are to be conserved and used sustainably. Vital to this is the idea of inter- and intragenerational equity.⁵⁶

9.3 Assessing the SBEC statement of shared intent and the road ahead

Diplomacy remains a rather intriguing feature in the transaction of international business. An original draft on how to move ahead with the aspirations of SBEC was gently put forward. However, it was firmly rejected by key diplomats who were closely following Kenya's MFA draft of a concluding statement for SBEC 2018. Reading through that draft some two years later, one realizes the rejection was not so much because of the content, but rather that diplomats do not commit until they have an unequivocal clearance from respective headquarters. The end result, then, was the 'Nairobi Statement of Shared Intent'. One of the legacies of SBEC was the 'Leadership Commitment Segment', during which leaders from all walks of life made pledges, commitments and obligations estimated at US\$172.29 billion. Yet, at the closure, there was a reluctance to a fully commit in the manner which the main organizers of the conference had hoped.

⁵⁶ See the fundamental principles laid down during the first Rio Earth Summit (1992), later codified in the major ICJ (1997) decision in *Gabcikovo-Nagymaros (Hungary v. Slovakia)* and the 2010 *Argentina v. Uruguay Pulp Mills*.

Be that as it may, the ‘Nairobi Statement of Intent’ (presented as annex to this publication) captures certain critical aspirations that should guide the future of the global commons, anchored by the evolving concept of blue economy. For instance, it posits that

science and research are crucial for policy development, implementation and evaluation and that an interdisciplinary approach to science and research that includes bio-physical science, law and policy, human geography and accounting and finance, is required in generating state of the art evidence-based knowledge and information to inform policy and decision-making

and that these must include ‘the valuation of environmental goods and services in the blue economy’. The statement goes further, ‘Achieving tangible results in these areas will require new, bold and ambitious strategies, mobilization of significant financial resources, access to technologies and innovations, capacity building and effective governance arrangements’.

9.4 The Nairobi outcome and charting the road ahead

Ambassador Macharia Kamau, who was the main driver of SBEC 2018, has rightly argued in an internationally published op-ed, that the SBEC was essentially a ten in one conference spread across the entire city of Nairobi. As he stated, the conference included:

a historic, Leadership Commitments segment, a Business and Private Sector Symposium, a Governors’ and Mayors’ convention and a truly, ‘star-studded’ Science and Research Symposium segment to be hosted at the premier University of Nairobi. There shall also be Signature Thematic Sessions devoted to deliberations on the key productivity and sustainability pillars of the blue economy. Other key segments of SBEC include a Civil Society Symposium and an International Diaspora side event, as well as a Youth side event. And there is more, notably, a business and technology exhibition; a national museum and blue economy archaeology exhibition; a blue economy film and photography festival that will be coordinated and managed under the auspices of the Kenya Film Classification Board.

As already indicated, SBEC was organized around nine thematic areas. There were fora and side events, including the Business and Private Sector Symposium a Civil Society Organizations side event and a Youth Symposium, albeit a late inclusion into the already highly packed programme. Nairobi hoped the Signature Thematic Sessions would create awareness of the blue economy and build a global consensus and momentum around actions to sustainably harness blue economy resources. The rest of this discussion therefore focuses on how Nairobi hoped,




A panel discussion taking place at the science and research symposium.

and still hopes, to create a global consensus to join with the League of Developing Nations in a vision for an agenda that could transform a critical aspect of our collective humanity.

9.4.1 Towards establishing a global blue economy investment facility

Building on the global momentum generated by SBEC, subsequent discussions have made a wide range of proposals. The most persuasive of these, in our view, has been the call to establish a Global Blue Economy Facility (GBEF). In the words of the project design, this facility ‘is intended to help countries and stakeholders follow up on the extensive and deep commitments made at the SBEC 2018’. It goes further to indicate that ‘the facility will mobilize requisite financial resources, facilitate access to technologies and innovations, build capacity and make effective governance arrangements to deepen implementation for blue economy initiatives around the world’(BEICH & MF, 2018:2).⁵⁷ This visionary proposal went ahead to lay out the modalities for the establishment of a Blue Economy Investment Facility and Secretariat that is expected to also serve as a Clearing House and Monitoring Facility. This proposal, in our view, is an important and novel idea. First, and foremost, it emerges at a time when there is already much recognition of the great potential of the blue economy. However, in spite of the flurry of meetings and global conferences, it remains disturbing that not much decisive action has followed. At an initial meeting to discuss and share the BEIF proposal, it was not entirely surprising that one or two key stakeholders pointed to the fact that there are already a huge number of structures, institutions and agreements that

⁵⁷ See, the original, *Proposal: Establishment of the Global Blue Economy Facility* (Post-Sustainable Blue Economy Conference (SBEC 2018) Secretariat: dated, 17 December 2018, by the Ministry of Foreign Affairs, Government of Kenya. This has since been modified and will be promoted primarily as a Blue Economy Investment Facility (BEIF) in line with calls made at SBEC 2018.



could be aligned to accommodate the blue economy. They were certainly thinking about the GEF, the Green Climate Fund and the various financial arrangements embedded within other UN agencies, including UNDP and the UNFCCC's Bonn-based Secretariat. In terms of international agreements and conventions, these doubters were probably thinking of UNCLOS, the Convention on Biological Diversity and many others that have invariably tackled the whole gamut of issues around environmental protection and conservation.

In our view, the correct response is simply that among UN Member States there is a strong case to be made for establishing a viable institution and structures exclusively committed to advancing the promise of the blue economy. It goes without saying that many UN and global structures have become hugely bureaucratic and could respond only rather slowly to the evolving needs of changing circumstances in developing countries and in the SIDS in particular. Today, it is probably time to think of institutions and structures that facilitate quick action and whose impact are traceable, including through the opportunities presented by technological advances that were hardly available, say, when agencies such as UNEP was established. Indeed, with the expected lead of the private sector and investment segments of societies, we can only hope that the facility can meaningfully contribute to catalyse the sustainable reaping of benefits from the blue economy.

In Kenya, beyond the establishment of the aforementioned state departments, a lot of work remains to be done in terms of agreements on a policy and institutional framework. More importantly, whether the matter raises a great enough sense of urgency as to be adequately budgeted for and funded by the national exchequer remains to be seen. Similarly, an Africa-wide facility is a tall order for the simple reason that prevailing AU structures have experienced many difficulties in coordinating traceable and accountable activities among Member States. The Kenya-led BEIF proposal, however, provides an opportunity for thinking a new and investing wisely on a sustainable basis on the blue economy. It is possibly a timely recognition of the limitations of the public sector in shepherding what is a clearly urgent initiative that is intended to serve the collective humanity for generations to come. The promotion of the BEIF initiative is in part premised on the belief that the main business of governments and the public sector is to facilitate an enabling environment for investment. However, when it comes to timebound and urgent deliverables, the tasks must be entrusted to semi-autonomous institutions that can work in tandem with government for results, based on evolving public-private partnership arrangements. In this regard, the BEIF proposal has provided for a voluntary structure membership for both state and non-state actors, who will be required to pay an annual subscription, to facilitate the required take off. A

Board of Directors is also proposed comprising no more than 20 key representative institutions, which can enable faster decision making and catalysis of investment opportunities.

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The Sustainable Blue



Economy Conference in Pictures







Annex 2: The Nairobi Statement of Shared Intent on Advancing the Global Blue Economy

Our ocean, seas, lakes, rivers and other water resources hold great promise for contributing towards the success of the UN 2030 Agenda and the SDGs. They can help drive economic growth, social prosperity and environment protection. While the world has not yet developed the full potential of these resources, unsustainable human activities are continuing to substantially threaten life under water and the resilience of aquatic ecosystems.

Inspired by the unique global opportunity to build greater prosperity for all, while protecting these water resources for the present and future generations, 16,320 participants from across the world including heads of state and government, ministers and high-level representatives, mayors and governors, representatives of international organizations, the business community, the private sector, women and youth, indigenous peoples, community-based organizations, philanthropic, academic, scientific and research institutions, as well as civil society had strategic conversations during the first-ever global conference on the sustainable blue economy held in Nairobi, Kenya from 26th to 28th November, 2018.

The conference convened at a time when the world population is at about 7.6 billion and growing to 9.8 billion by 2050. Participants recognized that with this population growth, demand for goods and services will also grow accordingly, and that this will exert additional pressure on land-based resources, which are slowly diminishing or already overexploited in many cases. Therefore, it welcomed the global interest in developing and conserving the resources of a sustainable blue economy to augment efforts at aimed poverty eradication and nutritional development.

With collective determination, and building on efforts at the local, national and international levels, the global community can intensify investments and harness the full potential of the oceans, seas, lakes and rivers to accelerate economic growth, create jobs and to fight poverty. Simultaneously, the world can improve the health of the oceans, seas, lakes and rivers and the ecosystems they support which are under increased threats and in decline in many countries and regions across the globe.

The development of a sustainable blue economy is possible with the full and effective involvement and participation of all relevant actors working together and is the primary purpose of SDG 14. Collaborative initiatives such as the Commonwealth Blue Charter are encouraged.

The public sector has limited capacity to finance the scale of investments needed to realize a sustainable blue economy. The private sector should step in to bridge

the financing gap. Governments should offer the right incentives including by designing policy mechanisms to encourage new and sustainable marine activities to succeed and by populating a pipeline of projects for willing investors, including small and medium enterprises. The private sector, in turn, can strengthen its social and environmental corporate responsibility in part through the development of knowledge and understanding of the value of the blue economy.

Science and research are crucial for policy development, implementation and evaluation. An interdisciplinary approach to science and research that includes biophysical science, law and policy, human geography, and accounting and finance is required in generating state-of-the-art evidence-based knowledge and information to inform policy and decision-making. This must include the valuation of environmental goods and services in the blue economy.

Cities and other human settlements are engines of economic growth powering social prosperity, cultural integration and tourism. Proper urban planning and management of coastal and lake-facing cities and towns will reduce vulnerability to disasters and risks including the negative impacts of climate change while waste management remains one the most urgent global challenges.

The survival of humanity, biodiversity and ecosystems depend on bold, innovative and collective vision and action. The desire to chart and develop a new paradigm for an economically vibrant, socially inclusive and environmentally resilient blue economy is now more relevant than ever.

The conference was an important platform for strategic deliberations on promoting the productivity, inclusivity and the sustainability aspects of the resources of a sustainable blue economy in an integrated, balanced and holistic manner.

Similarly, the conference contributed immensely towards a shared understanding of the elements of the concept, principles and building blocks of a sustainable blue economy (**annex 1**).

Key messages heard at the conference include the importance of:

- Promoting action-oriented global strategies that places people and the blue economy resources at the centre of sustainable development as a contribution to the realization of the UN 2030 Agenda for Sustainable Development and the SDGs;
- Promoting collaboration for sustainable partnerships and projects in the various sectors of the blue economy for economic growth, poverty alleviation and conservation of the resources for the present and future generations through a multi-sectoral approach;

- Promoting mobilization of finance from public and private sources, access to technologies and innovations as well as capacity building among local, national and international stakeholders for the full realization of the potential of the blue economy;
- Promoting the role of women in the blue economy and identifying the barriers and opportunities to further empower women and encourage their role in positions of leadership;
- Recognizing that gender equality and the empowerment of women will build a more peaceful, inclusive and prosperous world;
- Strengthening science and research to generate and disseminate evidence-based knowledge and information on advancing the sustainable blue economy;
- Strengthening science-policy interface of the blue economy resources to inform decision-making;
- Strengthening governance mechanisms for a sustainable blue economy including by raising awareness and ensuring stakeholder participation in policy and decision-making;
- Promote synergies between local authorities and national governments in the implementation of decisions on blue economy including through the Governors and Mayors Global Symposium for the sustainable blue economy (SBE 1000);
- Sharing innovations, technologies, and best practices and experiences within and across regions.
- In the interim, special attention could be paid to scaling up productive and conservation activities in the nine priority areas deliberated at the conference:
 - smart shipping, ports, transportation and global connectivity;
 - employment, job creation and poverty eradication;
 - cities, tourism, resilient coasts and infrastructure;
 - sustainable energy, mineral resources and innovative industries;
 - managing and sustaining marine life, conservation and sustainable economic activities;
 - ending hunger, securing food supplies and promoting good health and sustainable fisheries;
 - climate action, agriculture and fisheries, waste management and pollution-free oceans,
 - maritime security, safety and regulatory enforcement; and,

- people, culture, communities and societies – the inclusive blue economy.

A sustainable blue economy builds on unlocking the full economic possibilities of the oceans, seas, lakes, rivers and other water resources through investments that involve effective participation of all relevant people, while protecting the resources for present and future generations and ecosystem resilience.

Countries and other stakeholders can work closely to promote a sustainable blue economy by building understanding and galvanizing further action at various international Symposiums, including at the 2020 UN Ocean Conference and at UNGA.

Achieving tangible results in these areas will require new, bold and ambitious strategies, mobilization of significant financial resources, access to technologies and innovations, capacity building and effective governance arrangements. To mobilize requisite financial resources, the possibility of establishing a Blue Economy Investment Clearing House and Monitoring Facility could be explored.

With the global community working individually and collectively, the pledges and commitments made during this conference can be implemented (**annex 2**).

The conference expressed sincere gratitude to the primary host and convener, the Government of Kenya, and to the governments of Canada and Japan for their generosity in co-hosting a very stimulating conference. It also expressed appreciation to co-sponsors for their support to the conference (**annex 3**).

NAIROBI, KENYA
November 28th, 2018

ANNEX 3: H.E. President Uhuru Kenyatta's Commitment Statement for the Sustainable Blue Economy

(Extracted from the full statement delivered during the conference.)

Our agenda for these water resources is noble, and our ambitions are high. They give us life and sustenance. We must in turn protect and nurture them.

That is why we have convened to commit to innovative and transformative ways of using and sustaining our oceans, seas, lakes and rivers.

Like all of you, I am encouraged by the economic prospects of these resources. Yet, I am also deeply concerned about the challenges facing them.

To this end, therefore, I am here to make a personal pledge.

I am convinced that for the sake of the present and future generations and for the continued viability of our ecosystems, we have to envision a different future and therefore a different model for the blue economy. I pledge to envision that future and do my part to promote it.

We need to adopt appropriate policies, strategies and mechanisms to re-energize our economies, create greater opportunities and jobs for our people while fighting the perennial scourges of hunger, disease and dependence among our citizens and the blue economy holds great promise in this regard.

We need to confront, head-on, the challenge of waste management and plastic pollution that is compromising the health of our people and oceans, seas and rivers as well as threatening food security and the biodiversity on land and at sea. In this regard, governors and mayors, businessmen and women, and the youth, alike, around the world have an immense responsibility.

We need a double assurance of responsible and sustainable fishing to conserve the endangered species and high value fish stocks on which millions of people depend for daily livelihoods.

We need the double assurance of safety and security in the high seas so that global trade, connectivity and all businesses can thrive unhindered and unfettered.

On the basis of these extremely urgent imperatives, I pledge that in Kenya, I will lead from the front.

- I have already established a state department fully responsible for fisheries, aquaculture and blue economy matters; and revived our maritime department and related key ministries.

- I have commissioned a new fisheries complex jetty to enable docking of large fishing and patrol vessels and announced the establishment of a fishing corporation.
- We have revived the Kenya National Shipping Line and initiated a training programme for Kenya sea farers on ships across the vast oceans.
- We shall establish a Kenya Maritime School, building on our existing training college to expand our capacity and capabilities.
- To combat illegal, unregulated and unreported fishing, I launched the Kenya Coast Guard also last week building on our experience with Kenya Navy.
- We have in recent years refashioned our ports authority and our harbours and began the construction of large deep-sea harbour facility in our north-western region, in Lamu.

My personal priorities and commitments for the blue economy are:

- One:** ensuring revival of our maritime transport, by building and expanding our ports, and shipping facilities and launching our deep-sea capabilities drawing greater business participation in;
- Two:** developing our fisheries, by increasing aquaculture, fish processing and storage capacities and related blue economy industries, thereby creating jobs and growth of employment opportunities for our people;
- Three:** extending the reach and effectiveness of our maritime conservation and other aquatic conservation to reach all our water bodies;
- Four:** building decent and affordable housing in our coastal cities and redeveloping lakefront cities and towns and opening them up to their great touristic and sustainable industrial potential; and
- Five:** enhancing security and safety of our collective waters by establishing a Coast Guard that secures our seas and lakes and stops illegal, unreported and unregulated fishing.

Kenya wants to contribute to a better and prosperous world.

I invite all of you to work with my government in promoting sustainable partnerships and projects including through availing financial resources, transfer of technology and innovations as well as capacity building in all these five key areas.

I remain optimistic that together; the journey we have begun today will succeed.

I remain committed!

ANNEX 4: The Science and Research Symposium Programme

DATE: 26–28 November, 2018

VENUE: University of Nairobi, Chandaria Hall

| TIME | ACTIVITY |
|---|--|
| Day 1: Monday, November 26, 2018 | |
| 12:30 | Registration |
| 13:15 – 14:30 | Lunch and welcoming remarks <ol style="list-style-type: none"> 1. Ambassador (Dr) Amina Mohamed, CAV, EGH, Cabinet Secretary, Ministry of Education, Science and Technology 2. H.E. Masahisa Sato, State Minister for Foreign Affairs of Japan 3. H.E. Audrey Azoulay, Director General, UNESCO |
| 14:30 – 15:00 | Keynote address: The role of science and research in advancing a sustainable blue economy Moderator: Prof Micheni Ntiba (Kenya), P–PS–SDFA&BE Panel discussion (30 minutes) <ol style="list-style-type: none"> 1. Dr Marie-Alexandrine Sicre, President, Scientific Committee of Oceanic Research 2. Prof. Michael Doods, Vrije Universiteit, Brussels |
| 15:00 – 16:00 | Plenary: Demystifying the sustainable blue economy Keynote speaker: Japan (10 minutes) Moderator: Dr Divaldo Rezende Panel discussion (35 minutes) <ol style="list-style-type: none"> 1. Vladimir Ryabinn, Intergovernmental Oceanographic Commission 2. David Murrin, Director General, Ocean, Coastal and River Engineering, National Research Council of Canada 3. Prof. Martin Thuo, Iowa State University 4. Dr Aref Fakhry, World Maritime University 5. Prof. Li Jian, National Institute of Marine Development, China Discussion and Q&A session (15 minutes) |
| 16:00 – 16:30 | Photo session and tea/coffee break |
| 16:30 – 17:40 | Plenary: Investing in blue economy research, innovation and human capital Keynote speaker: Prof. Paul Connolly (10 minutes) Moderator: Dr Sunil Sweeneyrain Soobashand |

| TIME | ACTIVITY |
|--|--|
| | <p>Panel discussion (35 minutes)</p> <ol style="list-style-type: none"> 1. Doug Wallace, Dalhousie University, Nova Scotia 2. Michael Felix Dodds, Global Research Institute University, North Carolina 3. Dr Jacqueline Uku, Kenya Marine and Fisheries Research Institute 4. Prof. Jeremy Prince, Biospherics Pty Ltd, Australia <p>Discussion and Q & A session (15 minutes)</p> |
| Day 2: Tuesday, November 27, 2018 | |
| 08:30 – 9:00 | Registration & meet and greet session |
| 09:00 – 10:00 | <p>Plenary: The role of science in infrastructural economics and marine spatial planning</p> <p>Keynote speaker: Dr Nigel Bradley (10 minutes)</p> <p>Moderator: Prof. Joseph Kamuzhanje</p> <p>Panel discussion (35 minutes)</p> <ol style="list-style-type: none"> 1. Ammar Kanaan, CEO, Till Group 2. Philip Olale, Nairobi Centre for Advanced Studies, Environmental Law 3. Japan TBC 4. Scott Mclean, Ocean Networks Canada 5. Dr Julius Francis, Western Indian Ocean Marine Science Association (WIOMSA) <p>Discussion and Q & A session (15 minutes)</p> |
| 10:00 – 10:30 | Tea/coffee break |
| 10:30 – 13:00 | <p>Concurrent Breakaway Sessions</p> <p>1. Education and building capacities (Room MLT 01)</p> <p>Moderator: Guiseppe Pace</p> <p>Panel discussion (90 minutes)</p> <ol style="list-style-type: none"> 1. Dr Alida Bundy: The inclusive blue economy: integrating humans and nature into ocean science for management, governance and opportunities 2. Prof. Kwasi Appeaning Addo: IDRC projects climate change adaptation research and capacity development in Ghana and Deltas 3. Dr Beatrice Matiri-Maisori: Knowledge management and the blue economy: an exploratory research 4. Agnes Muthumbi: Aquaculture for food security: the role of academic and research institutions in Africa <ol style="list-style-type: none"> 1. Jackson Efitre: Building capacity for climate change mitigation and adaptation <p>Discussion and Q&A session (60 minutes)</p> |

| TIME | ACTIVITY |
|------|--|
| | <p>2. Aquaculture resources (Room MLT 405)</p> <p>Moderator: Prof. Mucai Muchiri</p> <p>Panel discussion (90 minutes)</p> <ol style="list-style-type: none"> 1. Dotan Eyal: Advanced aqua farm with food and economic security 2. Harrison Charo-Karisa: Aquaculture plans for Africa 3. Prof. Min Kuan-Hong: Sustainable aquaculture in the blue economy 4. Veronica Hiojosa Sardan: IDRC Amazon Fish for Food project, Bolivia 5. Paul Orina: State of cage culture in Lake Victoria Kenya <p>Discussion and Q&A session (60 minutes)</p> <p>3. Pollution-free water bodies (Room MLT 404)</p> <p>Moderator: Mr Joseph Dennis</p> <p>Panel discussion (90 minutes)</p> <ol style="list-style-type: none"> 1. Dr Christophe Frankiewicz: Minimizing heavy metals in landfills and waterways through unique commercially viable approaches 2. Dr Cornelius Were Okello: Climate action, waste management and pollution-free aquatic systems 3. Lucie Kirstein: Decarbonation pathways for international maritime transport industry 4. Hans-Otto Portner: climate change and ocean acidification 5. Bronte Tilbrook: Global ocean acidification observations support the sustainable use of marine resources 6. Stephen Mangi: The economic implication of ocean acidification on shellfish fisheries and aquaculture: UK case study 7. Briony Coulison: Oceans and plastic pollution <p>Discussion and Q&A session (60 minutes)</p> |
| | <p>4. Maritime security (Room MLT 03)</p> <p>Moderator: Dr Francis Vorhies</p> <p>Panel discussion (90 minutes)</p> <ol style="list-style-type: none"> 1. Prof. Peter Kagwanja: Maritime security and the blue economy: a knowledge and research agenda 2. Constance Gikonyo: Criminalization of maritime privacy: a challenge to maritime security, safety and enforcement 3. Njoki Mboce: Tenacity of maritime security threats: case for a more effective multilateral enforcement 4. Ammar Kanaan: Growing the blue economy through marine transport logistics 5. Prof. Jianying Ma: Director, Centre for Marine Security Studies <p>Discussion and Q&A session (60 minutes)</p> |

| TIME | ACTIVITY |
|---------------|--|
| 13:00 – 14:00 | Lunch break |
| 14:00 – 16:00 | <p>Concurrent Breakaway Sessions</p> <p>1. Mapping blue economy resources (Room MLT 01)</p> <p>Moderator: Juan Valle Robles</p> <p>Panel discussion (90 minutes)</p> <ol style="list-style-type: none"> 1. Prof. James Njiru: RV Mtafiti and oceanographic research in relation to blue economy and investments 2. Prof. Norbert Opiyo Akech: Exploring technological and policy solutions for sustainable and inclusive development of the blue economy for developing countries: a focus on mineral and energy resources 3. Koen Vanstaen: The value of information realizing the economic benefits of mapping marine resources <p>Discussion and Q&A session (30 minutes)</p> <p>2. Fisheries (Room MLT 405)</p> <p>Moderator: Dr Tatjan Batas</p> <p>Panel discussion (90 minutes)</p> <ol style="list-style-type: none"> 1. Catherine Lambert Koizumi: Indigenous communal fisheries in a co-management framework as a successful model for sustainable marine resource use and social economy in Canada 2. Prof. Julius Manyala: Application of artificial neural networks (ANN) to fish catches and environmental data: a predictive approach to fisheries resilience 3. John Burton, CEO, POLE AND Line Foundation: Developing sustainable fishing one by one fishing 4. Dr Gladys Okemwa: Marine capture fisheries and opportunities for blue economy growth 5. Dr Christopher Aura: Capture fisheries in freshwater lakes in relation to the blue economy 6. Hezbon Onyango: From how many to how much? Economic and financial valuation of Lake Victoria fisheries, Kenya 7. Alice Mutie: Potential of preparing highly gel-formable gelatin from fish scales waste <p>Discussion and Q&A session (30 minutes)</p> <p>3. Climate change (Room MLT 404)</p> <p>Moderator: Pierre Failler</p> <p>Panel discussion (90 minutes)</p> <ol style="list-style-type: none"> 1. Prof. Olof Linden: Climate change 2. Nathan Bindoff: Impacts of climate change on marine biodiversity and ecosystem function, ocean physics and chemistry, including heat waves 3. Dr James Kairo: Mainstreaming blue carbon ecosystems into national development and climate change agenda |

| TIME | ACTIVITY |
|---------------|--|
| | <ol style="list-style-type: none"> 4. Charlotte De Fontaubert, World Bank: Impacts of climate change to sectors of the blue economy 5. Dr Judith Gobin, Deputy Dean, Faculty of Science and Technology, University of West Indies <p>Discussion and Q&A session (30 minutes)</p> <p>4. Regulatory regimes (Room MLT 03)</p> <p>Moderator: Jo-Anne Akroyd</p> <p>Panel discussion (90 minutes)</p> <ol style="list-style-type: none"> 1. Prof. Robin Maho: Developing a global picture of regional ocean governance arrangements: applying the Governance Effectiveness Assessment Framework (GEAF) in the wider blue economy 2. Prof. Ben Sihanya: Intellectual property rights and the blue economy (How do you secure intellectual property rights?) 3. Dr Akunga Momanyi: Towards a more inclusive global economy regime: the case for a better global framework 4. Dr X.N. Iraki: Exceptionalism of the blue economy in Africa <p>Discussion and Q&A session (30 minutes)</p> |
| 16:00 – 16:20 | Tea/coffee break |
| 16:20 – 17:40 | <p>Concurrent Breakaway Sessions</p> <p>1. Community mobilization and involvement (Room MLT 01)</p> <p>Moderator: Anu Chaudhary</p> <ol style="list-style-type: none"> 1. Panel discussion (60 minutes) 2. Prof. Peter Blair, Oxford University, UK 3. Megan Baily: Sustainable fisheries and communities 4. Dr Steven Cole: IDRC project on combining post-harvest fish value chains and social change interventions in Zambia and Malawi 5. Prof. Henry Mutembei: Research activities at WMI: blue economy strategy 6. Philip Olale: Governing the land–sea continuum: role of spatial planning in controlling pollution in sustainable management of Kenya’s coastal marine zone 7. Prof. George Imbenzi <p>Discussion and Q&A session (20 minutes)</p> <p>2. Sustainable use of non-biological resources (Room MLT 405)</p> <p>Moderator: Nigel Bradly</p> <p>Panel discussion (60 minutes)</p> <ol style="list-style-type: none"> 1. Prof. Craig Houghton: Ecosystems services for wellbeing in deltas: integrated assessment for policy analysis in coastal Bangladesh 2. Prof. John Onyari: The potential of blue economy resources |

| TIME | ACTIVITY |
|--|---|
| | <p>3. Nobert Opiyo: Exploring technological and policy solutions and inclusive development of the blue economy</p> <p>Discussion and Q&A session (20 minutes)</p> <p>3. Climate action resilience (Room MLT 404)</p> <p>Moderator: Prof. Joseph Kamuzhanje</p> <p>Panel discussion (60 minutes)</p> <ol style="list-style-type: none"> 1. Manuel Barange: Fisheries governance in the context of climate change 2. Paal Bakken: Regeneration of ocean forest: importance of seaweed 3. Bryony Townhill: Too hot to handle? Or simply too complicated to communicate. 4. Dr Sophia Johannessen: Blue carbon sequestration in seagrass meadows: a misunderstood carbon sink 5. Michelle Devlin: Ecosystem resilience and human impact in the Pacific oceanscape: current status and future directions <p>Discussion and Q&A session (20 minutes)</p> |
| Day 3: Wednesday, November 27, 2018 | |
| 08:00 – 10:00 | <p>Plenary: Summary of Outcomes from the Breakaway Sessions</p> <p>Moderator: Dr Beatrice Matiri-Maisori</p> <p>Repertoires</p> <ol style="list-style-type: none"> 1. Role of science and research in advancing a sustainable blue economy 2. Demystifying the sustainable blue economy 3. Investing in blue economy research, innovation and human capital 4. The role of science in infrastructural economics and marine spatial planning 5. Sustainable use of resources 6. Climate action resilience 7. Global connectivity and transport 8. Blue economy and sustainable cities |
| 10:00 – 10:20 | Tea/Coffee Break |
| 10:20 – 12:30 | <p>Call to Action</p> <p>Keynote speaker Rtd Admiral Robin K Dhowan (10 minutes)</p> <p>Plenary: High-Level Commitments</p> <p>Moderator: Prof. Collette Suda</p> <ul style="list-style-type: none"> • Countries and governments • High-level research institutions • Multilateral organizations • Civil societies • Private sector • Other stakeholders |

Annex 5: Convenor, Co-Hosts and Main Sponsors of SBEC 2018



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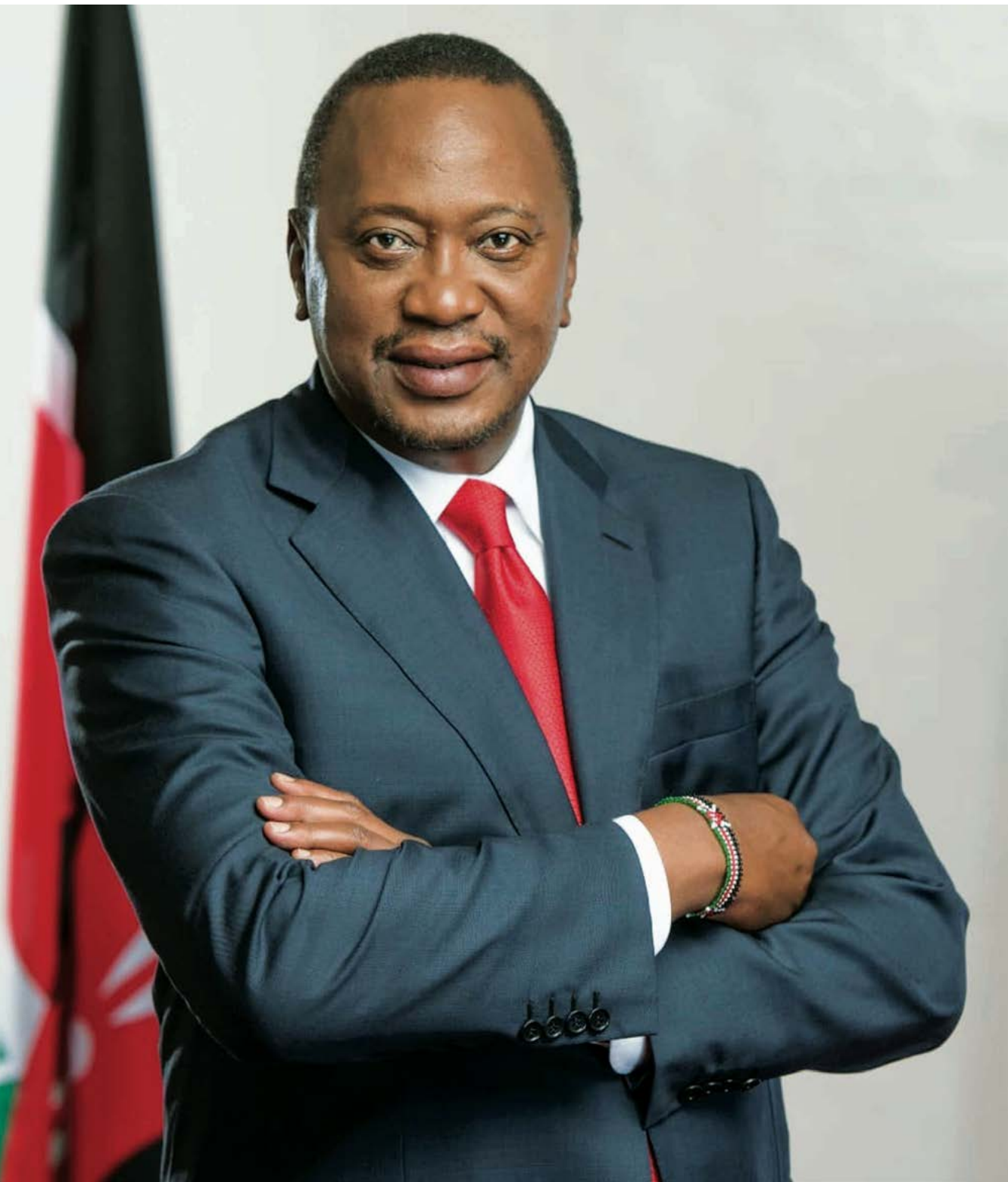
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- The Java House Group.



HE President Uhuru Kenyatta, chief host of the Sustainable Blue Economy Conference 2018.

This legacy publication of the first-ever *Sustainable Blue Economy Conference* (SBEC) is an attempt to piece together key thematic issues and concerns that featured prominently at the 'Science and Research Symposium' segment that was hosted at Kenya's premier, University of Nairobi, as one of the signature events of the SBEC 2018.

The book is presented in nine short chapters and includes discussions of some of the initiatives already taken, particularly by the host country (Kenya) in advancing the blue economy agenda. One key purpose in convening SBEC 2018 was to trigger on a global scale, the sustainable harnessing of what the publication categorically refers to as the 'the promise' of the blue economy.

Overall, the publication is mainly a synthesis of the issues and some of the ideas that were discussed by researchers and scholars. The book is complementary to the *SBEC 2018-Book of Abstracts*, which is published separately. In instances where full academic papers were made available, (Chapters 3, 6 and 7), they have been revised with inputs from the respective authors, and published with their permission, in order to advance scholarly work on the blue economy-related issues and concerns. In other instances, the book synthesises emerging issues largely from the deluge of Microsoft PowerPoint presentations and rapporteur notes in order to extract and highlight key messages.

It is hoped that the publication of this book will lay the foundation for full articles, including further research in areas that the researchers so robustly canvassed. If the publication thus succeeds in pointing to the science and research issues that are vital to the productive and sustainable harnessing of the blue economy's resources, while also mapping the agenda as laid out by the pioneering research community that gathered in Nairobi in November, 2018, it shall have fulfilled its intended modest purpose.

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 www.blueeconomyconference.go.ke



REPUBLIC OF KENYA

