SCENARIOS FOR SOUTH AFRICA'S OCEAN ECONOMY TOWARDS 2060

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SCENARIOS FOR SOUTH AFRICA'S OCEAN ECONOMY TOWARDS 2060

By

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DECLARATION

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ABSTRACT

The ocean is becoming the new focal point in the discourse on growth and sustainable development, both at national and international levels. Scenario planning improves the quality of the strategic conversations that organisations need to have as a position in preparing for the future. In this research, scenarios for South Africa's ocean economy towards 2060 were developed and explored by considering the six key ocean sectors as outlined in the Operations Phakisa Strategy, namely, Marine Transport and Manufacturing, Offshore Oil and Gas Exploration, Aquaculture, Small Harbours, Coastal and Marine Tourism, Marine Protection Services and Ocean Governance. The research process was guided by Inayatullah's six pillars and linked methods towards scenario development. Existing studies do not take into consideration the various social, technological, economic, environmental, political, legislative and ethical factors influencing the growth of the ocean economy.

With the ocean increasingly being considered a new economic frontier, sustainable development has become pertinent for supporting and facilitating continued economic growth areas without compromising on environmental, social, or economic factors. Sustainable development within the ocean economy is further supported by Goal 14 of the Sustainable Development Goals, which focuses on conservation and sustainable use of the ocean, sea and marine resources.

A literature review was conducted to gain a better understanding of the ocean economy, and primary data was collected through a real-time Delphi platform and semi-structured interviews. The real-time Delphi collected information on the key megatrends that continue to shape the ocean economy and key drivers and wild cards that can affect the sustainability of the key ocean economy industries. In addition, semi-structured interviews collected information on the proposed scenarios and the capacity needed in growing and promoting a sustainable ocean economy for South Africa towards 2060. A scenario matrix was developed for South Africa's ocean economy and four scenarios and their implications were analysed. The preferred scenario was a resilient ocean economy towards 2060. The study also took a step forward with a view to provide reference to stakeholders and governments in progressing towards a possible scenario and developed an integrated vision for a sustainable ocean economy for South Africa towards 2060. This proposed vision is to mitigate against future challenges, collaborate and proactively utilise the development opportunities offered by the ocean economy.

Keywords: Ocean economy, scenarios, future study methods, sustainability, real-time Delphi, semi-structured interviews, integrated vision

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LIST OF ACRONYMS AND ABBREVIATIONS

AI:	Artificial Intelligence
AU:	African Union
BRICS:	Brazil, Russia, India, China and South Africa
CLA:	Causal-Layered Analysis
DAFF:	Department of Agriculture Forestry and Fisheries
DEA:	Department of Environmental Affairs
DEFF:	Department of Environment, Forestry and Fisheries
EIU:	Economist Intelligence Unit
FAO:	Food and Agriculture Organisation
GDP:	Gross Domestic Product
ILO:	International Labour Organisation
IMO:	International Maritime Organisation
IoT:	Internet of Things
IPCC:	Intergovernmental Panel on Climate Change
IUCN:	International Union for Conservation of Nature
OECD:	Organisation for Economic Co-operation and Development
OHI:	Ocean Health Index
SDGs:	Sustainable Development Goals
WEF:	World Economic Forum

CHAPTER ONE

INTRODUCTION, BACKGROUND AND STUDY SCOPE

1.1 INTRODUCTION AND BACKGROUND

The quest from humans to be better prepared for the challenges of the future has existed for many decades. To date, most scenario development and analysis have been created in the private sector and the military, however, scenario work is increasingly being used by scientists and policymakers to better understand potential future changes in drivers such as climate change, human population and demands for food and energy, and to address the associated uncertainties (Wilkinson & Krupers, 2013; Wilkinson & Ramírez, 2010). Scenarios support increased understanding of the plausible future implications of current trends to help inform sustainable management strategies and support flexible long-term planning (Department of Environmental Affairs, 2013). Assumptions and forecasts that were made previously about the likely trajectories of the coming decade towards 2030 and sustainability have been thrown up into the air by the impact of COVID-19 (OECD, 2020b), and the quest to be better prepared for the future is becoming more important.

The ocean is becoming a new focal point in the discourse on growth and sustainable development, both at national and international levels (Economic Intelligence Unit, 2015; World Bank, 2019). The Organisation of Economic Co-operation and Development (OECD, 2016) and the World Bank (2016) estimated that the ocean economy contributes approximately USD 1.5 trillion annually, or roughly 3% of global value added. The ocean is increasingly considered as a new economic frontier, driven by a growing population in search of new sources of growth and rapid technological advances making new resources accessible (Tralac, 2018). The ocean economy encompasses economic activities that depend on the sea, often associated with other economic sectors, including tourism, maritime transport and manufacturing as well as oil and gas and fishing. The ocean economy is a key component in global economic growth and development, offering great opportunities (Economist Intelligence Unit, 2015; Potgieter, 2018).

It is important to value and understand the ocean and further note that the ocean economy has forward and backward linkages with various sectors of the economy (OECD, 2016; Ebarvia, 2016). Forward linkages mean processing commodities that are used as raw materials, while backward linkages are much broader and imply that the sector is an important input that favours positive interaction among different maritime industries and sectors, namely, transport, logistics and fishing. The backward and forward linkages confirm the connectedness of ocean industries with land-based industries and quantify the benefits of investment in the ocean industries for the whole economy (OECD, 2016).

The ocean environment sustains and facilitates a wide range of economic activities, not only shipping transport, recreation and fishing but also governmental industries, like navigation aids and information, weather forecasting, defence, sea rescue, policing and customs, marine and coastal management, research and education as well as mining, farming (aquaculture), pharmacology, science and technology as well as energy generation (Department of Environmental Affairs and Tourism, 2000; Hosking, Du Preez, Kaczynsky, Hosking, Du Preez & Haines, 2014). With the development of the Operation Phakisa Strategy (Department of Environmental Affairs; 2014), South Africa's oceans were estimated to be able to contribute up to R177 billion to the GDP by 2033 (compared to R54 billion in 2010) and possibly lead to the creation of 22 000 new direct jobs by 2019 (Department of Environmental Affairs; 2014; Funke, Claassen, Nortje, and Meissner; 2016). As at 2020, Operation Phakisa had R40.8 billion investments and 7 385 direct jobs across the six ocean sectors (Department of Environment, Forestry and Fisheries; 2020a). The Operation Phakisa Strategy focuses on six growth areas that are prioritised to contribute towards unlocking the economic potential of South Africa's oceans, based on their potential contribution to economic growth and job-creation. These growth areas include:

1. Marine transport
2. Offshore oil and gas exploration
3. Aquaculture
4. Marine protection services and Ocean governance
5. Small harbours development
6. Coastal and marine tourism

Across the globe, an increasing number of initiatives are focusing on the ocean. The 2030 Agenda for Sustainability also known as the Sustainability Development Goals (SDG), especially SDG 14, as well as domestic pressure to address global ocean pollution and the new economic opportunities arising from the ocean economy are all driving this rise in a focus on ocean action (OECD, 2016). Many new initiatives and much of the attention are centred on ocean plastics, an issue that has become more of a focal point for concern about the marine environment than the more radical changes to behavioural, political and economic systems needed to achieve a healthy and productive ocean (Stafford & Jones, 2019 cited in OECD, 2020a). The ocean industry continues to develop beyond just maritime trade and fisheries to include service-based activities. Ocean ancillary services, such as logistics, banking, insurance, maritime law, ship classification, bunkering, crewing, and information technology provide essential support to the operations of ports and shipping, which serve as the conduit for national, regional and international trade (Ebarvia, 2016).

The OECD (2016) identified a wide range of global trends and macro-factors, which are set to influence the longer-term development of the ocean economy. The combined effect of global trends and macro-factors coupled with the opportunities of expanding economic, social and health-related opportunities through ocean use, will likely further increase the pressures already weighing on the ocean's health (Findlay, 2018). The trends and drivers within the ocean economy are likely to be related to the structure and settlement patterns of the world's population, to global economic developments such as growth, international trade and rising incomes, advances in science, technology and innovation as well as climate change effects (OECD, 2016). It should, however, be noted that governance and geopolitical factors are also likely to play an important part in the longer run in shaping the future of the ocean economy and sustaining the growth attributed to the ocean economy. According to the World Wildlife Foundation (WWF-SA) (2016), South Africa's rich and productive coastal waters support thousands of jobs and contribute millions of rand to the national economy each year, with coastal goods and services estimated to contribute 35% to South Africa's Gross Domestic Product (GDP). The development of a South African ocean economy lies at the heart of its maritime security and ocean governance policies and practices at national, regional and international levels (Walker, 2018).

Ocean economies, both large and small, are looking to their seas to bolster slowing growth in their terrestrial economies, discover new opportunities for investment and employment, and build competitive advantage in emerging industries such as deep seabed mining and marine biotechnology (Economist Intelligence Unit, 2015). The ocean economy is complex and dynamic, therefore, necessitating the researcher to follow a qualitative methodology that used mixed methods versed in transdisciplinary research to achieve the aims of the study. Through this research, the researcher aimed to peer into the future by extrapolating recent trends to see what the scenarios for South Africa's ocean economy towards 2060 might be. The use of a mixed method research approach allowed the researcher to complement one method with another to achieve a solid understanding of multiple methods used in development studies to analyse the ocean economy, determine sustainable growth and develop scenarios and a visioning process for South Africa's ocean economy towards 2060. This research also allowed the researcher to facilitate communication, promote collaboration, and provide advanced research for the global, regional and the South African ocean economy.

This chapter provides an introduction and background to the ocean economy and clearly identifies the research objectives and the importance of the ocean economy. It further explains the problem statement, limitations and challenges that warrant a scenario development process for South Africa's ocean economy. Using a qualitative scenario development approach and sequential mixed method research through a real-time Delphi and semi-structured interviews, the study focused on the key sectors in the Operations Phakisa Strategy in line with the vision and goals set for fully exploring South Africa's ocean economy. The six key sectors that formed part of the study were Marine Transport and Manufacturing, Offshore Oil and Gas Exploration, Aquaculture, Small Harbours, Coastal and Marine Tourism, Marine Protection Services and Ocean Governance. Lastly, the chapter concludes by providing an outline for the research and key definitions that guide and provide perimeters for the study.

1.2 PROBLEM STATEMENT

The topic is of significance owing to the growing global focus on the ocean economy. The African Union Agenda for 2063 is aimed at building and accelerating the implementation of past and existing continental initiatives for growth and sustainable development (African Union, 2013). For the ocean economy, growth and sustainable development is further elaborated in the overarching vision of the 2050 Africa Integrated Maritime (AIM) Strategy (African Union, 2014). The strategy fosters increased wealth creation from Africa's ocean and coast by developing a sustainable thriving ocean economy in a secure and environmentally sustainable manner (African Union, 2014). Human aspirations and economic growth continue to exert pressure on the ocean and the marine ecosystem and, therefore, constitute serious challenges for sustaining growth within all the six sectors highlighted in the Operation Phakisa Strategy as being essential for growing the ocean economy. A good example of such challenges is that of the world's diminishing fish stocks as highlighted by the Food and Agriculture Organisation (FAO), where only an increase in fishing effort and expansion to new species and new areas have maintained catch levels over the last twenty years (FAO, 2016). Although expert calculations of the degree of overfishing vary, official FAO (2016) estimates show that more than a quarter of all stocks are overfished, and more than half of all stocks are fished to maximum capacity. Pollution from vessels and coastal communities further pose a challenge towards growth initiatives targeted at the ocean economy, which warrants research that takes into consideration the multi-dimensional and complex nature of developing the ocean economy (UNCTAD, 2012).

Rogerson and Rogerson (2019) cite Engel (2018) on Operation Phakisa and its ability to constitutes a method for planning developmental state interventions as well as a set of concrete activities targeted to boost the country's economy. Emphasis is upon planning the ocean space that has been styled, perhaps decorously, as South Africa's "tenth province" (Van Wyk, 2015). Several aspects of the planning methodology used in Operation Phakisa have attracted criticism. The actual planning process involved more than 650 officials and so-termed experts who brainstormed on the commodification of South Africa's ocean resources. Rogerson and Rogerson (2019) further cite Masie and Bond's (2018: 320) reflection that the near two-month planning process "was a helter-skelter, non-consultative, elite navel-gazing and ultimately unrealistic exercise, devoid of awareness of the capitalist crisis bearing down on South

Africa's two oceans". Potgieter (2018:51) points out the Operation Phakisa Strategy and discussions focused primarily around economic gain rather than a holistic plan for a sustainable ocean economy that takes into consideration the ocean's health.

Previous research initiatives have also failed to obtain a coherent picture of the likely future of the ocean economy analysing all six key sectors (Marine Transport, Offshore Oil and Gas Exploration, Aquaculture, Marine Protection Services and Ocean Governance, Small Harbours Development and Coastal and Marine Tourism). This is because different methodologies, various time horizons and different assumptions have been applied to these research initiatives focusing on specific sectors within the ocean economy (for example, environmental sustainability and global economic growth and trade). As captured in the OECD (2016) report, the inter-linkages among the various ocean sectors were not previously captured since they are single sector studies. For example, Rogerson and Rogerson (2019) cite Masie and Bond (2018) on the gathered cohort of officials, experts and researchers that developed the Operation Phakisa Strategy and how they overlooked or were blind to the broader crises evident in the political economy of oil and shipping, which reduce the prospects of major opportunities for South Africa. Various initiatives such at the "Future of the Ocean Economy" project attempted to mitigate against the single sector research approach by projecting the development of the global ocean economy towards 2030 based on an enhanced ocean-industry database and a model based on broadly consistent assumptions and parameters (OECD, 2016). The OECD (2016) projections were mainly made up of a *"business-as-usual*" or baseline scenario, which assumes a continuation of past trends, no major policy changes, no abrupt technological or environmental developments and no major surprises. Literature further indicates that the demand for secondary goods and employment growth from the ocean-based industries continues to progress along the same trajectory towards 2030 (OECD, 2016). Claassen, Funke, Lysko and Ntombela (2014) introduced four scenarios for the South African maritime sector (the Maritime Nation scenarios) and reflected on how to best utilise these scenarios as a tool to support decision-making, future planning and action for the sector. However, existing studies do not take into consideration the various social, technological, economic, environmental, political, legislative and ethical factors influencing the growth of the ocean economy.

1.3 RESEARCH OBJECTIVES

Combining qualitative and quantitative research components to expand and strengthen a study's conclusions and, therefore, contribute to the published literature is one of the overall goals of mixed methods research. Research objectives briefly describe what the research is trying to achieve. Sections 1.3.1 and 1.3.2 outline the primary and secondary research objectives that the researcher achieved through analysing the impact of interventions and complexities offered by the ocean economy and ultimately developing scenarios for South Africa’s ocean economy towards 2060.

1.3.1 Primary research objective

The primary objective of this research was the development of scenarios for South Africa’s ocean economy towards 2060 by considering the six key ocean sectors as outlined in the Operations Phakisa Strategy (Department of Environmental Affairs, 2014). This process was guided by Inayatullah’s (2008, 2013) six pillars and linked methods towards future studies and scenario development. The study was further informed by contributions from pure academic sources, government publications, consulting practices, public and private stakeholder engagements, technology providers, academia, industry experts, industry views and business realities.

1.3.2 Secondary research objectives

The secondary research objectives (ROs) that further supported the primary research objective included:

- RO1: To determine the characteristics of the ocean economy, internationally, regionally and in South Africa by investigating definitions, the status quo and trends.
- RO2: To analyse the developmental role of the ocean economy in South Africa within the context of the global development agenda
- RO3: To analyse the drivers of change in South Africa and how they influence the growth and sustainability of the ocean economy
- RO4: To investigate new and innovative solutions in the ocean economy as alternatives with the highest potential to drive sustained ocean economy growth

- RO5: To develop a range of possible scenarios for South Africa's ocean economy towards 2060 and select a preferred scenario in ensuring a sustainable ocean economy for South Africa towards 2060
- RO6: To analyse the key components of the global development agenda and the implication of the various scenarios for South Africa's ocean economy
- RO7: To investigate the necessary capacity and support needed and which role-players can effectively collaborate in the implementation of a sustainable and integrated vision for South Africa's ocean economy towards 2060

By developing scenarios for South Africa's ocean economy towards 2060, this research allowed the ocean economy sector and other key stakeholders to identify future challenges and possible disruptions as well as to utilise the development opportunities proactively that were offered by the ocean economy, something that the OECD (2016) and the four scenarios developed by Claassen et al (2014) never addressed. Various scenarios for South Africa's ocean economy, which incorporate different economic, demographic, environmental and socio-economic futures were, therefore, a key focus of the research.

1.4 RESEARCH QUESTIONS

A research question is a specific inquiry, to which the research seeks to provide a response. A key characteristic of futures studies and scenario development is the use of questions to contextualise (Creswell, 2013), and to encourage new ideas and innovations (Bogie, 2010). According to Inayatullah (2013), these questions should focus less on narrowly-defined problems, and six basic futures questions are proposed that can be used to guide the process of constructive questioning. The focus of the questions for this research are presented in chapter 2 under table 2.1 and include the complex systems and processes needed in understanding the ocean economy, its developmental role as well as the social, economic, ecological and cultural factors that influenced the ocean economy growth prospects in the years leading up to 2060. This served the basis for the main research question and the sub-questions that this research attempted to answer.

1.4.1 Primary research question

The primary research question for this research is:

What scenarios can promote a sustainable ocean economy for South Africa towards 2060 taking into consideration the six key ocean sectors as outlined in the Operations Phakisa Strategy?

1.4.2 Secondary questions

The primary research question was further supported by the following secondary questions (SQs):

- SQ1: What are the characteristics of the ocean economy, internationally, regionally and in South Africa (looking at definitions, the status quo and trends)?
- SQ2: What is the developmental role of the ocean economy and what implications does the ocean economy have on sustainability and economic growth- internationally and in South Africa?
- SQ3: What are the drivers of change in South Africa and how do they influence the growth and sustainability of the six sectors within the ocean economy?
- SQ4: What emerging issues need to be taken into consideration in mapping a sustainable ocean economy for South Africa towards 2060?
- SQ5: What range of scenarios can be developed in ensuring a sustainable and a preferred ocean economy for South Africa towards 2060?
- SQ6: What are the key components of the global development agenda and how does each scenario link to the global agenda and South Africa's ocean economy?
- SQ7: Do the necessary capacities and support exist in the country, and which role-players can effectively collaborate in the implementation a sustainable and integrated vision for South Africa's ocean economy towards 2060?

1.5 SCOPE OF THE STUDY

Scenarios allow audiences to learn and think about plausible futures, and about the signposts en route to these futures, enabling them to better manage long-term risks and proactively seize emerging opportunities. Depending on the process used, scenarios can also challenge the assumptions that people have about the future. The basic purpose of scenario planning is to improve the quality of the strategic conversation that organisations need to have in position in preparing for the future. Future studies are mainly concerned with understanding social realities and concepts or constructs, which create the future as well as the development of sustainable future-oriented vision, which can inspire communities and entities (Adendorff, 2013). Modern futures research has three unique areas as epistemology of knowledge (Malaska, 2003 cited by Kuosa, 2010, p 331). Firstly, syntax, which contains the methods, such as scenarios, Delphi and Futures Wheel, which all are characteristic for futures research. Secondly, semantics, which contains the value-rational substance areas of the field. These interest areas include global issues, late-industrial crisis, information society, technology trends and climate change. Thirdly, pragmatics, which contains the deeds and actions of futures research. Kuosa (2014) queries which kind of strategies, policies, planning, design, empowerment, or provocations are relevant to cause desired effects. The study makes use of syntax in the form of scenarios, semantics looking at global issues and challenges as highlighted in chapter 3 and pragmatics which looks at actions of future research as will be discussed in chapter 7 and 8. The study predominantly uses a qualitative research approach to develop preferred scenarios for South Africa's ocean economy towards 2060.

1.6 DELIMITATION OF THE STUDY

The development studies discipline is multidisciplinary and focuses on the evolution of nations from political, cultural, geographical and socio-economic perspectives. It emerged as an academic discipline during the late part of the 20th century amid growing concerns for third world economies struggling to establish themselves in the postcolonial era. More recently, academics turned their attention towards Western states, seeking to address today's (and tomorrow's) most pressing issues by studying their cultural and political development. In other words, development studies is about understanding the current political landscape by examining their origins, which then enables academics, politicians and world charity organisations to make better plans for the future (Sumner, 2006). With South Africa placing more emphasis and efforts on developing the ocean economy, inter- and transdisciplinary research and development that are aimed at growing the ocean economy are becoming popular with government, businesses, research and students, with more emphasis being placed on environmental or sustainability studies and bear direct relation to topics and methodological approaches dear to the development community (Boulay, 2021). Modern approaches in development also suggest shifting from traditional normative thinking towards adaptive, complexity-aware approaches, which encourage resilient and adaptive policies responsive to change (Sumner, 2006; UNDP, 2014).

1.7 PRELIMINARY LITERATURE REVIEW

The literature review section gives a critical evaluation of what has been published around the six key sectors mentioned in the scope of the study (see Section 1.5) for the ocean economy by accredited scholars and researchers. This section is extended by providing an overview of the ocean economy globally, the ocean's contribution to wealth and the global development agenda for the ocean space. The literature review is important as it provides a global perspective on what the ocean economy entails, who the drivers of the ocean economy are, the notion of sustainability and the relevance of future studies in developing possible future scenarios for the global and South African ocean economy towards 2060. The literature review provides an overview of the ocean economy globally, the ocean's contribution to wealth and development, the global development agenda and drivers in the ocean economy.

1.7.1 Ocean economy globally

The ocean is a source of food and provides livelihoods for a significant portion of the global population with food as well as means of transport for approximately 80% of global trade (UNCTAD, 2012; OECD, 2016; DEFF, 2020a). The ocean economy offers a number of opportunities for sustainable and equitable blue growth in both traditional and emerging sectors (Department of Environmental Affairs, 2014). This increased number of activities and interest in the ocean space creates large uncertainties, which result in a new urgency for future development. The development of ocean economy sectors is influenced by a combination of environmental, social, economic and policy issues and drivers, which have been evident in discussions about the future of ocean resources across regions (UNCTAD, 2012) and is of utmost importance to policy makers, scientists and citizens alike.

The OECD (2016) further maintains that internationally, societies seek economic development and environmental protection at the same time from or for the ocean. A paradigm shift is imperative to fight against global crises that drive human civilisation towards a grave threat. OECD (2016) divides these global crises into three significant categories, namely:

- Climate change, which causes seawater temperature to rise, sea-levels to rise and ocean acidification.
- Resources depletion, which causes an insufficient supply of food, energy and water.
- Economic decline, which means the world economy has fallen into recession after the world financial crisis in 2008 and has not been recovered yet.

These three identified crises present global as well as national and regional common challenges for human beings. In the 21st century, the major ocean countries have reassessed the value of the ocean and coast and have actively established strategies to develop and protect them in addressing the crises that they face (Field, Hempel & Summerhayes, 2002). An understanding of the assessment done by the various countries on the value of the oceans and coasts as well as strategies developed in moderating the global crisis as identified by OECD (2016) is key in understanding the ocean economy globally and in developing plausible futures that will continue to promote sustained ocean economy growth.

1.7.2 Ocean contribution to wealth and development

The economic contribution of the ocean is significant, but remains undervalued (Economic Intelligence Unit, 2015; OECD, 2016). Unfortunately, in 2021, the economic contribution of the ocean remains undervalued, where the value of non-market goods and services, such as carbon sequestration, coastal protection and recreation as well as cultural and spiritual values are concerned. Oceans contribute significantly to human welfare, both directly and indirectly and, therefore, represent a significant portion of the total economic value of the planet (Costanza, 1999). The Economic Intelligence Unit (2015) indicated that measuring the ocean economy gives a country a first order understanding of the economic importance of the seas. Because of its diverse nature, the ocean economy offers new forms of emerging economic activities.

Furthermore, the Economic Intelligence Unit (2015) also note that investments in the ocean have traditionally consisted of those whose returns are linked to the ocean's living *renewable* resources (such as fisheries) as well as those who exploit the ocean's non-living, *non-renewable*, resources (including extractive industries such as dredging and offshore oil and gas, desalination and seabed mining). A number of industries that contribute to wealth and development (including tourism, coastal development, shipping and port infrastructure and services) are also reliant on the seas and the coasts as a setting for economic activities (Economic Intelligence Unit, 2015). Strategies and forecasts show that globally there will be continued growth within the ocean economy as regions and countries advance in skills, research, innovation, global trade and population growth all of which will result in a greater need for the ecosystem services and the food sources that the ocean can offer (OECD, 2016).

A maritime (shipping linked) environment is defined as one stretching 200 nautical miles (370 kilometres) inland from the sea and 200 nautical miles outward to sea from the land (Department of Environmental Affairs, 2014). The ocean part of the maritime environment falling under South Africa's jurisdiction stretches 3924 km along the coast from the Orange River mouth in the West to the Mozambique border in the East (Department of Environmental Affairs, 2014). It is a distance of 370 kilometres from a defined coastal baseline (a line connecting mean low water marks) out into the Southern Atlantic Ocean in the West and Western Indian Ocean in the East and includes the islands of Prince Edward and Marion (Hosking et al, 2014). The four coastal provinces of South Africa are the Northern Cape, Western Cape, Eastern Cape and Kwa-Zulu Natal and approximately make up the land region of the maritime environment. Together they accounted for about 40% of the GDP in 2010 (39% in 1995), and about 33% was generated within local and metropolitan municipalities bordering the sea (Department of Environmental Affairs, 2014; StatsSA, 2017).

The highest current valued contribution of the ocean sector within the South African economy is found to be in the primary sector, mainly due to the influence of the fishery industry. Hosking et al. (2014) cites that the ocean sector contributed about 6.3% of the total primary sector GDP. This compares with a 2.8% contribution to GDP in the secondary sector and a 4.6% contribution in the tertiary sector, the latter being boosted by the shipping and recreation industrial activities (Hosking et al, 2014). DEFF (2020a) cite that investments in the ocean economy have mainly been in infrastructure development (in ports), marine manufacturing (boatbuilding), aquaculture and scientific and seismic surveys, coastal and marine tourism, small harbours and marine protection services as well as ocean governance. According to the DEFF (2020a), the breakdown of the total sectors analysis in terms of GDP contribution and jobs created in 2010 and projections towards 2024 area includes:

- 2010: GDP contribution at 4.4% (R110 billion); 316 000 jobs (direct and indirect)
- 2019: GDP contribution at 4.2% (R130.1 billion); 692 048 jobs (direct and indirect)
- Projections for 2024, assuming sustained growth: (For re-assessment in current economic climate) GDP contribution at 4.3% (R143.4 billion); 779 213 jobs (direct and indirect)

(DEFF, 2020a)

The total sector analysis further identified that there is a need to re-assess the projections in light of the global and local economic climate as well as in light of the current growth rate in terms of the South African economy (DEFF, 2020a).

1.7.3 Global development agenda

It has been said that the major challenge for the future of life on this planet is achieving a species of development that increases wealth and reduces poverty while sustaining the natural resources upon which such a development is necessarily based (Visbeck, Kronfeld-Goharani, Neumann, Rickels, Schmidt, van Doorn, Matz-Lück, Ott & Quaas, 2017). The challenge of sustaining natural resources was taken up and institutionalised in the framework of the United Nations (UN) *Agenda 21. Further to Agenda 21.* This is an action plan for achieving sustainable development in the 21st century and was a major outcome of the UN Conference on Environment and Development in Rio de Janeiro in 1992. The challenge was affirmed, and further elaborated upon at the subsequent conferences devoted to this topic. To accelerate the still rather slow progress being made in achieving sustainable development at the global level, the recent UN Conference on Sustainable Development in 2012 (*Rio+20*) produced a document called *The Future We Want.* The document not only emphasises the need for action but also agrees on a set of measurable Sustainable

Development Goals (SDGs) to support focused and coherent action in priority areas at the global level (United Nations, 2012b). The seventeen SDGs (as shown in Figure 1.1) are based on *Agenda 21* and they build on initiatives and indicators measured in terms of the Millennium Development Goals (MDGs) of 2000.

Figure 1.1: Sustainable development goals

Source: United Nations (2015)

The SDGs, as represented in Figure 1.1, retain the broad systematic perspective and global orientation of development whilst considering country-specific situations, which are a key element for developing preferred futures for any region or country (Oberholster, 2017; Christie, 2005). With the ocean becoming a key frontier for development, it remains important that planned activities, operations and aspirations for growth are in line with the SDGs (United Nations, 2015). SDG 14 is dedicated to humanity’s interactions with the oceans. It covers a range of issues around conservation and sustainable use, with seven targets and three means of implementation to respond to the urgent need for transformative change toward more sustainable practices. Oceans cover around 71% of the Earth's surface and perform a vital regulatory function in the global weather and climate systems. Even the livelihoods and lifestyles of people living far inland often depend directly on rainfall and temperature patterns moderated by distant oceans. SDG 14 recognises the environmental, economic and social benefits that healthy oceans provide, and the resources and services that are linked with addressing issues of reducing inequality, economic growth, decent work for everyone and climate change (United Nations, 2015).

In developing a sustainable balance between often competing ecological and economic imperatives, the concept of the ocean economy (also referred to as the blue economy) was established and has been further elaborated in the *Blue Economy, Abu Dhabi Declaration of 2014* (UNEP, 2015). In addition to the highlighted SDGs, the Rio+20 outcome document points to several avenues for the implementation of its programme of action, including components that relate to the ocean economy (United Nations, 2015). Elements of the programme of action include trade, finance, technology and capacity building. Establishing an effective governance regime for the ocean economy is essential to creating and regulating a sustainable balance between the utilisation of marine resources and the protection of marine ecosystems (Visbeck et al, 2017). The optimal use of natural resources (including marine resources) will be key in ensuring that ocean-related services and developments are sustainable and offer growth potential for current and future generations.

1.7.4 Drivers in the ocean economy

The relationship between human existence and the ocean is old and essential to the development of humankind. The ocean is a key driver of global trade and commerce, it is also an important source of food and energy and a great highway of strategic and military importance (Potgieter, 2018). Globally, the economic relationship with the ocean is also evolving in a number of important ways to keep abreast with the modern information revolution, globalisation, changes in production and trade, knowledge and labour markets, the opportunities presented by global demographic trends, urbanisation, global security and the impact of climate change (African Union, 2013). The ocean economy is likely to become an economic force not only in this century but also for several centuries to come (Economist Intelligence Unit, 2015; Gaines, Cabral, Free, and Golbuu, 2019). The drivers of ocean growth are many and varied and have their origins in mankind’s growing familiarity with the ocean environment (OECD, 2016). The drivers of the ocean economy include, but are not limited to, new technologies that make it feasible and economically viable to tap ocean resources. The drivers include longer-term growth and demographic trends fuelling the search for food security and for alternative sources of minerals and energy and seaborne trade and rapid coastal urbanisation, among others (Economist Intelligence Unit, 2015). As a setting for global trade and commerce, and as a significant source of food and energy, the ocean's contribution remains of great importance.

The ocean economy in the following 20 years or so is expected to grow enduringly and will be driven primarily by developments in global population, the economy, climate and environment, technology and ocean regulation and management (OECD, 2016). Population growth, quality of life, food security, urbanisation and coastal development are at the heart of growth in the ocean economy. It is anticipated that by 2050, an extra 2 billion people at least will need to be fed, raising demand for fish, molluscs and other marine foods from fisheries and aquaculture (OECD, 2016; FAO, 2016). The demand for goods and sea transportation will stimulate sea-borne freight and passenger traffic, shipbuilding and marine equipment manufacturing as well as exploration for offshore oil and gas reserves (OECD, 2016; Gaines et al 2019).

As urban cities become dense and the quest for a better-quality life increases populations will continue to target coastal destinations for holidays, cruise tourism, retirement homes, and motivate the medical and pharmaceutical communities of the world to accelerate marine biotechnological research into new drugs and treatments (Field et al, 2002). Along with the population, the economy is one of the most dynamic drivers of developments in the ocean economy. Although the long-term prospects for global economic growth, and for the OECD area remain modest, GDP per capita is expected to rise significantly over the next three to four decades. Since around 90% of international freight is carried by sea, the impetus to the shipping business and ports will be considerable and global freight trade could more than triple by 2050 (OECD, 2016). The OECD (2016) report further projects an expanding share of world production located in China, India and Indonesia (almost 40% by 2030 and around 50% by 2050). The associated increases in incomes and wealth, especially in the burgeoning middle classes of the emerging economies, and some of the rapidly developing countries, demonstrate that a gradual shift in trade patterns eastwards is inevitable (OECD, 2016). The value propositions offered by ocean industries are increasing and can offer a number of growth prospects for countries (UNCTAD, 2012). Globally, great effort is already being given by shipping lines and shipbuilding companies to consider future challenges, trends and changes in markets, routes, types of cargo and types of vessel that will be required. Higher incomes and increasing consumption trends point to greater demand for marine tourism and especially cruise tourism, which will ultimately have a positive impact on the growth of the ocean economy (OECD, 2016).

1.7.5 South Africa’s ocean economy

An ocean economy approach was not central to African policy makers, yet as more than 90% of its trade is carried by sea, it is crucial for the economic growth and development of Africa (Sandrey, 2013; African Union, 2014; Tralac, 2018). Research shows that by 2027, an estimation of 500 million tons of cargo will go through the ports of the Southern African Region (Royeppen, 2015). Though the economic importance of the ocean is evidential, good governance and maritime security will be required. South Africa has a long maritime history as it is astride the sea routes linking East to West, and the Atlantic with the Indian Ocean. South Africa has a coastline of 3924 kilometres and its Exclusive Economic Zone (EEZ) covers 1.54 million square kilometres (Department of Environmental Affairs, 2014). However, the vast South African continental shelf claims, focusing on the areas around the South African mainland as well as its island territories of Marion and Prince Edward, will add close to a million square kilometres to South African territory (Van Wyk, 2015).

South Africa has abundant marine resources and considerable maritime infrastructure, which already contributes substantially to its GDP (Programme for Infrastructure Development in Africa, 2011; Department of Environmental Affairs, 2014). If fully-exploited and well-managed, South Africa’s ocean economy can constitute a major source of wealth and catapult the country’s fortunes (United Nations Economic Commission for Africa (UNECA), 2016). The maritime attributes within the country are not sustainably exploited to the full, hence the government’s intention is to speed up growth and development in the maritime sector as articulated in the National Development Plan and as part of Operation Phakisa (Zuma, 2015). Through Operation Phakisa, the South African government aims to fast-track ocean development initiatives in a sustainable manner and increase the ocean economy growth prospects (Findlay, 2018; Department of Environmental Affairs, 2014).

Commercially, activities taking place within the South African Maritime Zones include, but are not limited to, fishing, tourism, shipping, mining, renewable energy, agriculture and coastal geoengineering (Department of Environmental Affairs, 2014). South Africa's economy is largely dependent on maritime infrastructure and space for trading with foreign countries. Economically, about 90 to 95% of South African foreign trade in volume, to the value of approximately $34 billion in 2007 were through the maritime space. Coastal provinces are second to Gauteng in their contribution to Gross Domestic Product (GDP), at 38%. This highlights the importance of the coast in the country's economy. In 2007, about 30% of the country's population lived within 60-kilometre radius from the coast with approximately 80 people per square kilometre, making it one of the highest coastal population densities in Africa (Turpie & Wilson, 2011). South Africa has been in the midst of an ever-deepening power supply crisis since the late 2000s, in a large part due to a high-level of political intervention in the sector, and governance failures at the state-owned power utility, Eskom. Widespread, chronic load-shedding leaves households and businesses without power for up to 12 hours a day and has cost the South African economy up to R388 billion (USD 27.5 billion) over the past decade. While reliability has steadily decreased, consumer prices have increased more than fourfold since 2007. Meanwhile Eskom is tumbling further down its utility death spiral, requiring regular annual bailouts. It is on this basis that in 2020, Karpowership SA, a 49% South African Black-owned company, formed a partnership among Karpowership and power group SA to respond to the Risk Mitigation Independent Power Producer Procurement Programme (RMIPPPP) issued by South African government, Department of Mineral Resources and Energy (Karpowership, 2021). [1]Karpowership will be based within the ocean and it is basically a power ship that converts gas to electricity using reciprocating engines on-board the vessel (Karpowership, 2021).

The South African GDP in 2009 (current prices) was US$319 billion or R2.4 trillion (StatsSA, 2010). The largest contributing sectors were manufacturing, mining and quarrying as well as finance and business services, which are centred in the Gauteng Province. Agriculture, forestry and fisheries contributed 2.9% of the GDP, with

[1]Karpowership is a global and unique integrated energy company was established in 1948 and over the years it has diversified its portfolio to include renewables around the world. Powerships and LNG assets were established in 1996 and the company has 600 employees from 21 different countries and has created 10,000+ jobs around the world.

fisheries accounting for approximately 0.5% (StatsSA, 2010). The coastal provinces are, however, the second highest contributors to the GDP after Gauteng. In 2009, the coastal provinces on the east coast (Western Cape, Eastern Cape and Kwa-Zulu Natal) of South Africa contributed approximately 38% to the annual GDP (StatsSA, 2010), highlighting the importance of the coast to the South African economy.

The vision and goals set for fully exploring South Africa's ocean economy is captured in the Operation Phakisa Strategy (Department of Environmental Affairs, 2014) and the South African (SA) Marine Spatial Bill of 2017 (Department of Environmental Affairs, 2017). The bill provides a legal framework to unlock the ocean's economic potential by promoting cooperative spatial planning and promoting collaboration and a sustainable ocean governance arrangement. South Africa's shared vision for Marine Spatial Planning (MSP) is to achieve a productive, healthy and safe ocean that is accessible, understood, equitably governed as well as sustainably developed and managed for the benefit of all (Ramulifho, 2014; Department of Environmental Affairs, 2017).

The Marine Spatial Bill of 2017 further cites the goals for MSP as being the following:

- *Goal 1: Unlocking the ocean economy*
  This goal aims to stimulate the sustainable economic growth of South Africa 's marine sectors to increase the ocean contribution to the national gross domestic product, create jobs and, ultimately, eradicate poverty.

- *Goal 2: Engaging with the ocean*
  This goal builds on South Africa 's marine heritage and seeks to strengthen the country's marine identity. It aims to increase awareness of the value, opportunities and societal benefits of South Africa's ocean territory. It encourages all communities and citizens to engage in education about the sea, good stewardship and to participate in marine management.

- *Goal 3: Ensuring healthy marine ecosystems*
  This goal is aimed at protecting, conserving and restoring South Africa 's rich marine biodiversity by managing its living and non-living resources in a harmonious manner.

- *Goal 4: Contributing to good ocean governance*
  This goal requires a collaborative approach between all relevant government organisations with a remit in ocean matters, through the establishment of formal and informal relations.

(Department of Environmental Affairs, 2017)

In addition to the Operation Phakisa (Department of Environmental Affairs, 2014) and the Marine Spatial Bill of 2017 (Department of Environmental Affairs, 2017) , a Research, Innovation and Knowledge Management Road Map was commissioned by the South African Maritime Safety Authority (SAMSA) and developed by the South African Council for Scientific and Industrial Research (CSIR) in partnership with the South African International Maritime Institute (SAIMI) to unlock the country's ocean potential (CSIR, 2017). The *Road Map* emanated from extensive maritime stakeholder consultations, which resulted in eight objectives aimed at informing research, innovation, and knowledge management in the maritime sphere. These objectives include stimulating a maritime culture, creating and enabling governance frameworks, encouraging investments for growth and development, ensuring sustainable use of natural resources, harnessing multidisciplinary research, enhancing safety and security as well as encouraging national, regional, and international compliance (SANBI & Stats SA, 2018). The *mission* of the Road Map is for South Africa to be "globally recognised as a maritime nation" by 2030, and its implementation commenced in April 2017 through coordinated "theme-specific workshops" with stakeholders across the maritime sector (Council for Scientific and Industrial Research, 2017). In supporting the roadmap, this research further investigated the ocean economy, with specific focus on inclusive growth and the ocean economy's expected future developmental role.

The ocean economy has been chosen by the South African government, as one of the key sectors for Operation Phakisa because of the massive opportunity to create value that resides onshore and offshore (Department of Environmental Affairs, 2014). The planned research formulated four plausible scenarios and ultimately guided the process towards the preferred future for South Africa's ocean economy. The preferred future should be in line with the AU Agenda 2063, the 2050 Africa's Integrated Maritime (AIM) Strategy, the National Development Plan (NDP), the National Ocean Economy

Strategy (also known as Operation Phakisa) and the Dinokeng and Indlulamithi Scenarios for South Africa's economy. The areas that are interrelated and have the highest potential to drive sustained economic growth internationally, and, for the country, will form the basis for the future's triangle and the development of scenarios for South Africa's ocean economy towards 2060. Within the context of the developmental role of the ocean economy, the research further recognised that the sector in South Africa is, to a large degree, oriented towards sustaining international trade and transportation, but there are greater opportunities to expand the sector to be more inclusive and greater economic benefit for the country.

1.7.6 Relevance of future studies for the ocean economy

Since there is partial information and control about the future, knowledge about the future comprises "ideas and assumptions about the future, images and visions of the futures as well as the investigation of causalities that bring the logical consequences of certain events and trajectories" (Kuosa, 2010). Given that the future is not predetermined, and that it is difficult to study something which has not yet happened, every study of the future is "strictly speaking, the study of ideas about the future" (Wagar, 1996:366 cited by Milojević, 2002). It is an inquiry, or "the study of possibilities that are plausible in terms of present-day knowledge and theory" (Milojević, 2002). The role of futurists, is to "systematically study possible, probable and preferable futures including the worldviews and myths that underlie each future" (Inayatullah, 2013:37). Futures research has been and still is merely a group of different methods, methodologies, interest areas and approaches, which are attached to different (normal) sciences or fields of knowledge (Kuosa, 2009; Milojević, 2002).

According to Inayatullah (2013) and The Forward-Thinking Platform (2014), it is possible to not only anticipate and explore the future; but it is also possible to change it. In exploring the future, Adendorff (2013) identifies numerous different methodological approaches and techniques that have been developed over recent decades to explore and imagine possible, probable, preferable and plausible futures, which, according to Inayatullah (2013:37) include the worldviews and myths that underlie each future, and which identify alternative futures "through a fluid dance of structure (the weights of history) and agency (the capacity to influence the world and create desired futures)". Kreibich, Oertel and Wölk (2011:8) point out that the scientific study of futures studies, in the pursuit of studying “possible, desirable, and probable future developments and scope for design”, include not only conditions in the present, but also those of the past. Adendorff (2013:389) cautions though that “the future will not be an extension of the past, and, therefore, it can unfold in many ways, and can, more importantly, be shaped”. According to Kuosa (2010), futures studies generally can have four broad aims, namely, (i) to create interesting future images, visions and scenarios; (ii) to support planning and decision making; (iii) to help solving the great global questions of humankind and (iv) to develop applicable interdisciplinary methodology. Future studies, according to the Inayatullah (2008; 2013) as well as The Forward-Thinking Platform (2014), over the past fifty years have, however, moved from predicting the future to mapping and shaping alternatives or desired futures. As a result, the move by The Forward-Thinking Platform (2014) has become an executive function, with the ability to guide future business strategies. In summarising the various definitions, Inayatullah (2013) describes future studies as the systemic study of possible futures, including the worldviews and myths that underline each future.

Inayatullah (2008, 2013) further argues that future studies have the potential to assist governments, industry, investors and key stakeholders, to take advantage of the emerging business opportunities and international developments in the sector. Although it is accepted that the future cannot be predicted perfectly, future studies can inform decision-makers about possible future options, as well as the actions that can be taken (Oberholster, 2017). Consequently, they also could promote more effective strategic decision-making, which could be helpful especially in a more inclusive ocean economy for South Africa. Guidance to decision-makers is also provided by The Forward-Thinking Platform (2014), which suggests that they engage in thinking about the future of the ocean economy towards 2060 through different lenses and objectives. Given the developmental role of the ocean economy as a key emerging sector in South Africa and the critical need for innovation and collaboration in achieving growth and sustainability, the researcher has identified an inclusive ocean economy as one sector that needs the different lenses and objectives as suggested by The Forward-Thinking Platform (2014). Section 1.8 gives an overview of the conceptual framework, which provides a detailed analysis of the steps that were taken to respond to the research question to achieve the set objectives of the research.

1.8 CONCEPTUALISING THE STUDY

According to Mouton (2001), conceptualisation refers to both the clarification and the analysis of the key concepts in a study. In addition, it also clarifies the way in which the research is integrated into the body of existing theory and research. As it provides the underlying theoretical framework that guides and directs the research effort, clear and unambiguous definitions of the central concepts are, therefore, required. Such a theoretical framework is described by Collis and Hussey (2003) as a collection of theories and models from the literature. These models should explain the research questions or hypotheses.

A conceptual framework is an argument about why the topic being studied matters and that the means proposed to study it are appropriate and rigorous (Mouton, 2001; Collis and Hussey 2003). While a theory of the future is useful, a conceptual framework that is inclusive of strong theory and practice for understanding the future is still necessary. The conceptual framework for this research, which included a mixed methods research approach, was based on the six pillars of futures studies, as proposed by Inayatullah (2008, 2013). The first pillar is “mapping the future”, with its primary method being the environmental scanning process and the futures triangle (Inayatullah 2002, 2007). The second pillar is “anticipating the future”, with emerging issues analysis (Inayatullah, 2007) as the focal method. The third pillar is “timing the future”, with micro-, meso- and macro-history (Galtung & Inayatullah, 1997) being the most useful “methods”. The fourth pillar is “deepening the future”, with causal layered analysis (Inayatullah, 2004) being the foundation. The fifth pillar is “creating alternatives”, with scenario planning being the most important method. The last pillar, “transforming the future”, has visioning (Boulding, 1995) as its most important method and a crucial process for scenario development.

Mixed methods research approaches are popular in the social, behavioural and health sciences, in which researchers collect, analyse and integrate both quantitative and qualitative data into a single study or into a sustained long-term programme of inquiry to address their research questions (Creswell, 2013). The most common and well-known approach to mixing methods is the triangulation design (Creswell and Clark, 2003). The purpose of triangulation in research design as a data collection tool is to obtain different but complementary data on the same topic in order to best understand the research problem (Morse, 1991 cited in Creswell, 2013). Figure 1.2 presents a step-by-step conceptual framework for the research as guided by Inayatullah (2008, 2013) as well as the methods that were applied and the expected key outcome/s of each pillars and how the various pillars promoted triangulation and integrated both quantitative and qualitative research approaches.

Figure 1.2: Research conceptual framework

Source: Researcher’s own construction based on the proposed *six pillars of futures studies* as adopted from Inayatullah (2008) and Oberholster (2017).

1.9 RESEARCH METHODOLOGY

This section describes the specific methods of data collection that the researcher used in responding to the research questions and achieving the objectives of the research. The sections further expands on the reasons for the researcher analysing and collecting existing data as well as how the existing data assisted in the futures study approach of the ocean economy.

1.9.1 Research framework and research process

The mixed methods used in the research helped towards sketching possible developments within South Africa's ocean economy towards 2060 and formulating possible scenarios that could guide future actions by key stakeholders in the South African ocean economy. Futures and scenario building techniques have evolved owing to the change in the futures research paradigm from a more quantitative approach towards a more qualitative and process-oriented one (Amer, Diam & Jetter, 2012).

The analysis was suited for the study as it combined historical data and expert information through the real-time Delphi technique and semi-structured interviews to produce preferred futures for South Africa's ocean economy. The analysis and review of current literature on the future of the ocean economy internationally and in South Africa, further assisted the researcher to conduct semi-structured interviews with key stakeholders in the South African maritime space to develop scenarios and a preferred future for South Africa's ocean economy towards 2060. Quotes of key participants, transcriptions from interviews and other research techniques to create an understanding on the complexity of the many variables inherent in the phenomenon being studied, formed the basis of this study.

A mixed methods research approach was best suited to capture quantitative and qualitative approaches, as the researcher did not want to omit any important details in the ocean economy. It is important that the research design involved theoretical information that guided the steps that were followed with data collection and analysis. This was sequenced with a quantitative approach through the real-time Delphi and preceded by a qualitative data approach using semi-structured interviews. The study was predominantly qualitative and no aspects within the quantitative aspect of the study were used for generalisability. The researcher believed that using both qualitative and quantitative research approaches would result in a better understanding of the ocean economy and to developing plausible futures. By including both qualitative and quantitative data, the researcher explained both the research process and outcome of future studies and develop preferred scenarios for South Africa's ocean economy towards 2060. The research process is summarised in Table 1.1, which provides a general overview of the various stages and steps that outlined how this research was conducted:

Table 1.1: Research process

STAGE 1: Presenting ocean economy literature, the thinking and future implications	
Step 1: Identifying the research problem and unpacking the future study research methodology	Identifying research problem and identifying research aims and objectives
Step 2: Conducting the literature review	Selecting relevant research articles and books published on the ocean economy
STAGE 2: Identifying key trends and investigating key drivers and wild cards in the ocean economy	
Step 3: Conducting a sequential mixed methods research (quantitative and qualitative)	Using real-time / eDelphi tool to collect Quan and QUAL data for the study (purposive sampling using experts locally and internationally). Testing identified megatrends, key drivers and wild cards for SA's ocean economy
Step 4: Confirming megatrends in the ocean economy	Using the results from the real-time Delphi and analysis from semi-structured interviews to confirm the megatrends.
STAGE 3: Broadening the future of the ocean economy through alternatives	
Step 5: Developing scenarios process	In preparing for the scenarios, a CLA was conducted to ensure that the proposed scenarios of change for South Africa's ocean economy were analysed and significant. A scenario planning process was used to create four plausible scenarios that would be used to understand and manage the uncertainties that come with developing the ocean economy. This was in addition to using feedback from the semi-structured interviews.
Step 6: Developing a preferred future for South Africa's ocean economy towards 2060	Using the literature review data, real-time Delphi and semi-structured interviews to complete an ocean economy visioning exercise for South Africa towards 2060.
Step 7: Providing a summary and conclusion	Drawing conclusions and making recommendations

Source: Researcher's own construction

The research process presented in Table 1.1 is no different than the conceptual framework based on Inayatullah's (2008) six pillars to future studies. Table 1.1 provides an overall view of the study and highlights the three stages that will be followed in implementing the research process and building scenarios for South Africa's ocean economy towards 2060.

1.9.2 Sampling strategy

For both the quantitative and qualitative aspect of the research, a purposive sampling strategy was adopted for the real-time Delphi panel using a hybrid approach, where a maximum of 36 members were invited to the panel. The invitation was open to all real-time Delphi members who had expertise knowledge of the ocean economy and also to experts and decision makers not currently on the real-time Delphi platform. For the qualitative data aspect, semi-structured interviews were conducted with a minimum of eight and a maximum of 12 participants in South Africa who were key role players in the ocean economy. The total number of targeted participants for the study, who were experts with in-depth knowledge on the sector, was a minimum of 15 and a maximum of 50 participants for both the real-time Delphi panel and the semi-structured interviews. For the purpose of this research, the selection of participants focused on industry experts in the field of ocean economy development, scenario development or futures studies, with academics specialising in ocean-related industries and ocean governance, globally and in South Africa.

In addition, executive managers and decision-makers in the sectors linked to the ocean economy (namely, Maritime Transport, Fishing and Aquaculture, Oil and gas exploration and Marine Tourism), who potentially might use the outcomes of the real-time Delphi study, were also included as participants. The real-time Delphi software assisted the researcher with designing the online structured closed and open-ended questionnaire, reaching the participants (who were global and local experts in the ocean economy), collating the date and ensuring anonymity as well as handling the information flow on their responses on the ocean economy and the scenarios for South Africa's ocean economy towards 2060. The second round of participants, also selected through a purposive sampling strategy for the semi-structured interviews, were South African ocean industry players, government departments responsible for ocean economy development and academia, non-governmental organisations and community leaders in coastal communities.

1.10 CONTRIBUTION OF THE STUDY

Researchers and maritime nations are promoting a greater emphasis on the ocean and on supporting ocean economy initiatives aimed at growth and sustainability. A number of research studies have been conducted globally and in South Africa investigating the sustainability of the ocean economy, but very little has been done on the future studies methodology, incorporating foresight and scenarios for South Africa's ocean economy towards 2060. The research attempted to add theoretical, practical, policy implications and methodological contribution including:

a) **Theoretical value:** An exhaustive review of a variety of literature sources on the ocean economy, the developmental role of this sector and phases included in futures studies processes, scenario-based planning was undertaken. The aim was to integrate these independent research disciplines to current knowledge to make a unique contribution.

b) **Practical contribution:** The results from the environmental scanning and the scenarios were useful for promoting dialogue in various platforms on ocean economy development and the strategic designing of resource allocations. The proposed scenarios would provide leaders in South Africa with insights about how the future might unfold and propose recommendations that would be key in stimulating a maritime culture, creating enabling governance frameworks, encouraging investments for growth and development, promoting sustainable use of natural resources, harnessing multidisciplinary research, enhancing safety and security as well as promoting national, regional and international compliance.

c) **Policy implications:** The shaping of regulatory and policy frameworks on the ocean economy within the contexts of specific national and regional realities is key for a sustainable future. The contribution that this study made, was to assist policy developers and decision-makers or key role players in the South African ocean economy to better understand and use ocean economic growth as a key enabler to expand economic opportunities in South Africa. The key benefits that would also support the global-development agenda included:

- Creating inclusive and sustainable ocean economy developments, in various economic activities and sectors (for example, promoting the inclusion of woman and youth in fishing and aquaculture).
- Building/enhancing institutional capacity by way of a multi-stakeholder approach involving various stakeholders and partnerships in developing sustainable ocean economies.

d) **Methodological contribution:** This study generally had four broad aims: (1) to create interesting future images, visions and scenarios; (2) to support planning and decision making; (3) to help solving the great global questions of humankind and (4) to develop applicable interdisciplinary methodology (Kuosa, 2010). To expand on future studies and mixed methods research, the researcher found it beneficial to investigate an interdisciplinary study of the ocean economy by considering the key six ocean economy sectors in South Africa and applying a futures study approach in developing a preferred future towards 2060.

1.11 RESEARCH ETHICS

Futures studies and scenario development involves human subjects or participants and has the potential to raise unique and complex social, technological, economic, environmental, political, legal and ethical issues. Informed consent from participants was sought and no harm was caused during the research, or after, to the participants. The real-time Delphi technique is an iterative participatory-based process that was used to gather and evaluate expert-based knowledge on the future of the ocean economy towards 2060. The stakeholders engaged and the experts (also referred to as participants) formed part of the consensus and technical input needed on the scenarios for South Africa’s ocean economy towards 2060. The mixed method research involved human subjects and, in promoting basic ethical principles in research, respect for persons demanded that subjects entered into the research voluntarily and with adequate information (Belmont Report, 1979). The details of the participants would be kept confidential and only their contribution towards the research was key when testing the plausible scenarios and the visioning process within the research. This research followed a full ethics application research process, subject for reviewal and approval by the Nelson Mandela University Research Ethics Committee. The study has been approved as per the Nelson Mandela University Research and Ethics rules (Ethics Reference no: H20-BES-DEV-043 – See Appendix 1). The researcher took time to explain to the participants what the research entailed and what was required of them in terms of participation. The participants were also given the opportunity to decline participation in the study should they not feel comfortable with the research elements.

1.12 CHAPTER OUTLINE

A chapter outline provides an overview of the various chapters that will make up the research study and the main discussion or focus areas for the chapter. The outline also serves as a guideline as to what will be included in the chapter without being prescriptive and not allowing for additions or amendments in line with the research focus areas as key developments that might shape or change the nature of the study.

Chapter 1 (Introduction and background): This chapter served as an introduction, background and general orientation to the ocean economy, its developmental role and future studies. The chapter also presented the purpose, objectives, research questions and futures study methodology that was applied. The chapter also highlighted the distinct focus on the ocean economy (using definitions, diagrams and other historical data) and why there was a paradigm shift in terms of inclusive growth and the ocean economy.

Chapter 2 (Research methodology): This chapter focuses on the research design and the methodology of the study selected to address the research problem. The chapter explains the purpose of futures studies, as well as a motivation in favour of the application of futures study methodologies in gaining the growth of the ocean economy and the developmental opportunities presented by the ocean economy. The chapter also assesses the six pillars of futures studies in terms of their applicability to development studies and ocean economy growth. The relevant techniques related to each pillar is also be presented and discussed. The research followed a mixed methods research approach in accordance with guidelines as set out by Creswell (2013), Mouton (2001) as well as Leedy and Ormrod (2010).

Chapter 3 (Structure of the global ocean economy towards 2060): The chapter, which forms part of a detailed environmental scan of the ocean economy and its development role, provides insight into the sector. A review of the ocean economy development globally, as well as the key drivers for change, are presented. The chapter also assesses the ocean economy within a global context in terms of its ability to grow an economy (measured by its contribution to the Gross Domestic Product (GDP), alleviate poverty and promote greater inclusion within the ocean economy. Finally, the chapter highlights the key elements of the ocean economy, its development globally and trends and the contribution that the ocean economy has made in achieving the sustainable developmental goals aligned with the ocean and inclusive economic growth.

Chapter 4 (Key drivers and wild cards for South Africa's ocean economy): This chapter presents an inclusive theoretical ocean economy future model for South Africa, which includes the use of various future-research methodologies and approaches. The chapter also presents a casual layered analysis (CLA), which, in tandem with the futures triangle and an emerging issues analysis, is prepared on the output of the environmental scan, to deepen the understanding of the ocean economy, globally and within South Africa. A Social, Technological, Economic, Environmental, Political, Legal and Ethical (STEEPLE) analysis on the South African ocean economy provided the basis from which the proposed megatrends for South Africa's ocean economy were identified.

Chapter 5 (Megatrends and drivers for South Africa's ocean economy through the real-time Delphi method): This chapter presents the key elements of the real-time Delphi method, which was employed to check the future importance and probability of occurrences of the identified or proposed megatrends and drivers in the ocean economy. The method was applied to questions about the future, resource allocations, study designs, effective policies and decision-making. A detailed description of the real-time Delphi process as well as the suitability of the method for an ocean economy future study, is also presented. The implications of these trends as well as potential game-changing forces, regarding the future of South Africa's ocean economy, are also identified. The chapter also presents the outcome of a real-time

Delphi study as well as the final trends and driving forces used in the construction of scenarios for South Africa's ocean economy towards 2060.

Chapter 6 (Proposed scenarios for South Africa's ocean economy towards 2060): This chapter presents alternative, plausible and scenarios for South Africa's ocean economy towards 2060. Key definitions regarding scenarios and scenario planning as well as the purpose thereof and the value in development planning are presented. The chapter also presented a casual layered analysis (CLA), which provided the basis on which the scenario process was built to deepen the future for South Africa's ocean economy towards 2060. The chapter also provides an argument in support of scenario planning, as a tool to create alternative futures for ocean economy development. A detailed description of the steps and stages in the scenario developmental process for South Africa's ocean economy towards 2060 is also presented.

Chapter 7 (Integrated vision for the ocean economy in South Africa towards 2060): An integrated vision for the ocean economy in South Africa was prepared taking into consideration the scenarios developed, the developmental role of the ocean economy and the key six sectors identified for growth for South Africa's ocean economy. The chapter also presents practical guidelines to address the issue of growth and sustainable development for South Africa's ocean economy towards 2060.

Chapter 8 (Summary and conclusions): The chapter provides an overview of the research, with the research findings that are interpreted against the background of the original research problem and the research objectives. Chapter 8 provides an overview as to how each of the identified research questions were addressed and areas that provided key lessons during the research process. The conclusion and summary chapter also highlight the insights gained by the researcher regarding the study findings. The chapter discusses certain limitations of the research with specific recommendations for future research efforts.

1.13 DEFINITIONS

A definition bounds and characterises a concept and allows concepts to be interpreted as the writer would prefer without creating confusion for the reader. Previous research has shown that defining a term can invoke a universal concept only if the definition is clear (Saunders, Sim, Kingstone, Baker, Waterfield, Bartlam, Burroughs and Jinks; 2017). The definitions provided in the section are key focus areas for the research and they are used to provide clear delimitations for the research.

1.13.1 Ocean economy

The term *ocean* is used in this research to indicate that a broader emphasis of activities undertaken within the ocean's space and in the adjacent coastlines is considered (OECD, 2016). The activities highlighted by the OECD (2016) include shipping (maritime transport), ports, oil and gas exploration, coastal geoengineering, marine recreation and tourism, fishing, aquaculture and renewable energy farms. The concept of the ocean economy is further defined by Walker (2018:6) as that "portion of the economy that relies on the ocean as an input to the production process or which by geographic location, takes place on or under the ocean". Dwyer (2018) identifies the global significance of the ocean economy as the sum of the economic activities of ocean-based industries, and the assets, goods and services of marine ecosystems. Essentially, this ocean economy is a cluster of interconnected industries that incorporates a mix of established as well as newer activities. These activities include offshore oil gas exploration, shipping, shipbuilding and marine equipment, fisheries and fish processing, aquaculture as well as coastal and marine tourism. Park (2014) defines the ocean economy as economic activities that take place in the ocean, receive outputs from the ocean, and provide goods and services to the ocean. In other words, the ocean economy can be defined as the economic activities that directly or indirectly take place in the ocean, use the ocean's outputs, and put goods and services into the ocean's activities (Park, 2014). The ocean economy encompasses that "proportion of the economy which relies on the ocean as an input to the production process or which, by virtue of geographical location, taking place on or under the ocean" (United Nations, 2008; OECD, 2016). The terminology, definition, classification standard and scope differ by country in terms of distribution of coastal resource use taking into consideration the 200-nautical mile exclusive economic zone or the length of a country's coastline and the extent of upstream and downstream activities such as oil refining or fish processing from ocean economy activities (Park & Kildow, 2014).

For the purpose of this study, the ocean economy did not highlight the interests of landlocked countries and inland water ecosystems. Rather the ocean economy involved a large number of highly-productive activities whose results, if well-managed, could make a powerful contribution to South Africa's economic take-off such as trade and transport activities by sea, namely, port activities and industries, fishing and exploitation of fishery and aquaculture resources, mining, oil and gas resources, exploitation of renewable marine and hydraulic energies, seaside and coastal tourism as well as ocean technologies, marine protection services and governance.

1.13.2 Sustainability

In defining a sustainability concept that encompasses the ocean, it needs to be considered that the economic performance of a given society is sustainable, if there are genuine savings and investments in productive capacity (Visbeck et al, 2017). For Ebarvia (2016), a sustainable ocean-based economic model is one that is largely dependent on coastal and marine ecosystems and resources, but one that employs environmentally sound and innovative infrastructure, technologies and practices, including institutional and financing arrangements, for meeting the goals of:

- Ensuring sustainable and inclusive development
- Protecting the coasts and oceans, and reducing environmental risks and ecological scarcities
- Addressing water, energy and food security
- Protecting the health, livelihoods and welfare of the people in the coastal zone
- Fostering an ecosystem-based climate change mitigation and adaptation measures

A sustainable society is then described as a society that is economically viable, environmentally sound and socially responsible (Potgieter, 2018; Adendorff & Collier, 2015). In defining sustainability within the ocean economy, the researcher considered economic growth that did not destroy the environment as well as inter-generational and intra-generational equity. Improvements in areas related to the ocean economy (namely, natural resources overexploitation, manufacturing operations (energy use and polluting sub-products), linear consumption of products, direction of investments, citizen lifestyle, consumer purchasing behaviours, technological developments or business and general institutional changes) were also considered as the notion of sustainability was considered.

1.13.3 Inclusive growth

Reducing poverty and inequality has been the overriding concern of South Africa's development policies and programmes, from the onset of democracy in 1994 in the Reconstruction and Development Programme (RDP) through to the current National Development Plan: Vision 2030 (National Planning Commission, 2011). The guiding principle, as captured in the NDP, is that no political democracy can survive and flourish if the mass of the people remains in poverty, without land, without tangible prospects for a better life (National Planning Commission, 2011). Attacking poverty and deprivation must be the priority of a democratic government. The NDP posits that to raise the living standards to the minimum required level will involve various mechanisms, such as increasing employment opportunities, household and individual incomes and productivity as well as social protection and quality public services. The measure of success of government's development policies will be when the lives and opportunities of the poorest South Africans are transformed for the better (World Bank, 2018). The notion of inclusive growth for the ocean economy was based on the sector's ability to transform the lives of the poorest people currently active in the ocean industry and living within a radius of less than five kilometres from the ocean, river or estuaries (World Bank, 2018).

1.13.4 Futures studies

Inayatullah (2013) describes futures studies as the systemic study of possible and preferable futures, including the worldviews and myths that underline each future. According to Kuosa (2010), futures studies generally can have four broad aims: (1) to create interesting future images, visions and scenarios; (2) to support planning and decision making; (3) to help solving the great global questions of humankind and (4) to develop applicable interdisciplinary methodology (Kuosa, 2010; The Forward-Thinking Platform, 2014). Future studies, for Kuosa (2010) and Inayatullah (2013) as well as The Forward-Thinking Platform (2014), over the past fifty years have, however, moved from predicting the future to mapping alternative futures, and the shaping of desired futures. As a result, it has also become an executive function, with the ability to influence strategic decision-making (Inayatullah, 2013).

1.13.5 Smart population

There are many factors which cause the global population to fluctuate, with the post-world-war II baby boom causing the most significant increase (World Bank, 2015). According to the World Bank (2015), by 2100, the global population is expected to reach 11 billion people. However, this as an exciting opportunity to use the Internet of Things (IoT) in formatting smart cities. Although population growth comes with many positive factors, such as increased numbers of workers, expansion of tax bases and increased consumer spending at local businesses, it causes huge strain on resources and cities (World Bank, 2015), hence the notion of introducing and promoting smarter populations. For the purpose of this study, smart populations refer to people who are advanced in science and technology, promoting ocean economy development and improving the lives of citizens through technology and integrated ocean industry platforms.

1.13.6 Scenarios

A scenario approach involves developing future environment situations and describing the path from any given present situation to these future situations (Ratcliffe, 2000). As a method of studying the future, Inayatullah (2013) describes scenarios as metaphors of the possible that critique the present. Adendorff and Colliers (2015) define scenario-based planning as an enabler for decision makers to see the future in different plausible ways and serve as a rational way of doing strategic planning based on mutual understanding between the participants. In this study, a qualitative scenario development approach was adopted as this enables stakeholders to participate in agenda setting, visioning (exploring alternative sets of futures that contain both desired and undesired events) and in policy development (to explore pathways of action towards desired future targets). As a method, scenarios, therefore, offered an internally-consistent as well as a plausible explanation and description of how events might unfold over time for South Africa’s ocean economy towards 2060.

1.14 SUMMARY

The chapter provided a basis for the research and gave a brief introduction to the study as well as a background to the ocean economy. The chapter further identified the contribution that the study made from a theoretical perspective, policy implication, practical and methodological contribution. The research aim, objectives and questions that guided the research were clearly identified and formed the basis of what the researcher wanted to achieve. Definitions for key terms that formed the basis for the research and argument were provided as well as an overview of the chapters to follow and their respective focus areas. In Chapter 2, the research methodology is explained by considering various futures research methods, the purpose of futures studies, as well as a motivation in favour of applying futures study methodologies in analysing the ocean economy, the developmental opportunities presented by the ocean economy and scenarios for South Africa’s ocean economy towards 2060. Chapter 2 also assesses the six pillars of futures studies in terms of their applicability to development studies and ocean economy analysis globally and within the South African context.

CHAPTER TWO

RESEARCH METHODOLOGY

2.1 INTRODUCTION

Chapter 1 focused on introducing the study and the research objectives that the researcher would strive to attain in completing the research. An overview of what the ocean economy includes was provided, and future studies was defined as well as its relevance to the ocean economy. Chapter 1 also provided an outline on the conceptual framework that the research used to respond to the research questions and objectives. The introduction and background presented in the chapter provided the scope of the research and identified the elements which were key in formulating a plausible future for South Africa's ocean economy towards 2060. Chapter 2 focuses on the research design and the methodology selected to address the research problem. The chapter also explains the purpose of futures studies as well as providing a motivation in favour of applying futures study methodologies and scenario development in analysing the ocean economy and the developmental opportunities presented by the ocean economy. The chapter also assesses the six pillars of futures studies in terms of their applicability to development studies and sustainable ocean economies. The six pillars of future studies clearly outline the research process and the systematic approach that guided the scenario development process and a plausible future for the ocean economy. The relevant techniques related to each pillar are also presented and discussed. The research followed a mixed methods research approach in accordance with guidelines as set out by Creswell (2013), Mouton (2001) as well as Leedy and Ormrod (2010).

2.2 FUTURE STUDIES AND THE OCEAN ECONOMY

Future-oriented thinking is spreading across disciplines, industries as well as in practical life. The reason for the spread is that it is theoretically easier to maintain, develop and implement the long-term perspective of futures, synthesising-integration and adopting systematic thinking, in harmony with the other fields of future shaping (Degnarain, Stone & Waughray, 2017). The task and responsibility of the futurist is the quest for new directions, answers to new challenges, options or conflicts in the development, the discernment of queries and the intensification of involvement of various stakeholders in decision-making (Nováky, Hideg & Tóthné; 2017 cited in Kuosa 2014). Future oriented thinking intensifies the communication between futures, politics, business, governments and civic organisations to duly assess historical analogies, enhance the quality of models and scenarios and enable the clarification of concepts and the promotion of decision-making and action in shaping the future. With the oceans providing the platform for much of the world's economic foundation, the vital role that oceans play in climate and economies is an area that warrants future-oriented thinking (OECD, 2016; Degnarain et al, 2017).

2.2.1 Decision-making environment and the ocean economy

Availability and easy access to a wide range of natural and economic data on a country's oceans and coastal regions is the basis for strategic decision-making and forward planning.

More than 90% of global trade by volume is carried by ships, more than three-quarters of the world's mega-cities are by the sea, and more than 3.5 billion people depend on the ocean for their primary source of food (OECD, 2016). The end-product value of commercial tuna alone is a $40 billion global industry. In fact, when one takes account of the 200 nautical miles of coast each nation is entitled to call their own territory, 83 of the 193 nations in the United Nations are more than 50% ocean (Bergmaan, 2015; Degnarain et al, 2017). McKinsey & Company (in Degnarain et al, 2017) calculates that almost half the world's GDP growth to 2025 will come from 440 cities in these emerging markets, for example, cities like Tianjin in China or Porto Alegre in Brazil (OECD, 2016). Many of these emerging cities are on the coast and their growth will be in addition to the 75% of the world's mega-cities which are already coastally located. The pressures on the oceans from this new geometry of growth will increase exponentially. Unchecked, there will be a rise in biological and human-made waste materials (fertilizer run-off and plastics, in particular) spoiling estuaries and ocean ecosystems. There will also be a rise in pollution from aquaculture, thereby driving food safety fears, and further overfishing as well as Illegal, Unregulated and Unreported (IUU) fishing in deeper waters (Costanza, 1999; Degnarain et al, 2017). The latter poses a powerful political and economic factor that is key in decision-making.

2.2.2 Mitigating risk and uncertainty in ocean economy decision-making processes through scenarios

A scenario is not a future reality but rather a means to represent it with the aim of clarifying present action considering possible and desirable futures (Kosow & Gaβner, 2008). More simply put, a scenario is a description (usually of a possible future), which assumes the intervention of several key events or conditions that will have taken place between the time of the original situation and the time in which the scenario is set (Geldenhuys, 2006). Although unpredictable, various authors, such as Inayatullah (2013), The Economist Intelligent Unit (2015) and Oberholster (2017) argue that people are not powerless to confront the future. For scenarios to be both credible and useful, they need to respect the five conditions within the ocean economy, namely, pertinence, coherency, likelihood, importance and transparency (Glenn, 1994).

Economic activity in the ocean is also characterised by a complex variety of risks that need to be addressed. Foremost, are those related to ocean health from over-exploitation of marine resources, pollution, rising sea temperatures and levels, ocean acidification and loss of biodiversity (OECD, 2016). Scenarios have a knowledge function that cuts across various levels and can reveal the gaps and unpredictability that exist within the ocean economy (Geldenhuys, 2006; Kosow & Gaβner, 2008). The explorative function of scenario assists in developing a systematic approach towards an inclusive ocean economy development and deepens the existing understanding of contemporary developments, conditions and influences.

2.2.3 Expected outcomes of the research effort

The future of the ocean economy, similar to anything else involving the future, is full of complexity as developments and shifts in mutual interactions at many levels on the world stage follow courses which are at times unbroken but also, at times, disruptive (Kosow & Gaβner, 2008). The OECD (2016) indicate that the new “ocean economy” is driven by a combination of population growth, rising incomes, dwindling natural resources, responses to climate change and pioneering technologies. A key outcome of this research study was to take advantage of the opportunities that are offered by rapid technological and social progress, and to mobilise various role-players and key stakeholders in the ocean economy and coastal communities to promote an inclusive ocean economy through increased levels of education, participation and investment.

2.3 FUTURE STUDIES AS A RESEARCH METHOD

The need for forward planning and the quest to respond to international and national challenges are the basis for future studies. Kovacs (1970) cited in Inayatullah (2013) defines future research as an outer circle in planning, and initial research results clarify the connection between future studies and planning in the framework of socialism. Through future studies, futurists try to contribute to informed and wise choices by systematically studying possible, probable and preferable futures (Inayatullah, 2013). The systemic process of studying the future is strengthened through the provision of information dissemination sessions, planning, participation in public discussions on what constitutes the most desirable future and the best way to create it. The main aim of future studies is to challenge popular thinking by encouraging a critical examination of people’s current behavioural routines, considering alternatives, searching for overlooked possibilities, analysing goals and values and becoming more conscious of the future and the contribution that humans can make in creating a more sustainable future (OECD, 2006; Inayatullah, 2013).

2.3.1 Purpose of future studies

Future studies provide a foresight tool aimed at promoting proactive planning, identifying risks or disruptions and enhancing decision making (Inayatullah, 2013). In Oberholster (2017), it is mentioned by Cornish (2004) that the two purposes of future studies are, namely, as an empowerment tool that allows people to shape the future and it presents an opportunity to take advantages of possibilities that may exist. Inayatullah (2013) provides further guidance by distinguishing between planning and future studies. Inayatullah (2013) argues that planning intends to control and close the future, on the other hand, future studies as an approach, amongst various other outcomes, is committed to authenticate alternative futures, more participatory (including all types of stakeholders) and action-oriented approaches through creating alternative futures. Investigation into future orientation provides a bridge between the so-called consequence-futures emanating from past and distant future images that can be interpreted in a normative way, opening the way to a series of empirical studies

(Hideg et al, 2014). The growth of futures studies is also a result of the desire of government to find information that can aid in making better policy. Futures studies, along with systems analysis, is used to better understand the second- and third-order effects of specific policy decisions (Inayatullah, 2007).

A number of futurists (Toffler, 1978; Coates & Jarrat, 1989; Amara, 1991; Masini, 1993; Bell, 2003; Ratcliffe, 2011 as cited in Adendorff, 2013) recognise future studies as a tool to discover or invent, examine and evaluate as well as propose possible, probable and preferable futures. Bell (2003) defines futurists as people that seek to know what can or could be (the possible), what is likely to be (the probable), and what ought to be (the preferable).

Futures studies make use of questions to contextualise (Creswell, 2013), and to encourage new ideas and innovations (Bogie, 2010). According to Inayatullah (2013), these questions should focus less on narrowly-defined problems and proposed six basic futures questions that can be used to guide the process of constructive questioning (Oberholster, 2017). Table 2.1 shows that it is evident that the focus of these questions is more on complex systems and processes that are driven by social, economic, ecological and cultural factors. In addition, Creswell (2013) also proposed the use of both open- and closed-ended questions. In qualitative research, open-ended questions can effectively be used to allow participants to express their views within the context of these factors (Creswell, 2013).

Table 2.1 outlines the six basic futures questions. Some of these basic and supporting questions were incorporated in the study’s primary data collection process to ensure that all areas of concern around the ocean economy and scenarios, South Africa’s ocean economy and the identified six sectors were fully-explored

Table 2.1: Six basic futures questions

Area of concern	Basic question	Supporting questions?
Will	What do you think the future will be like?	• Will there be more and more progress and wealth? • Will there only be wealth for a few? • Will there be a dramatic technological revolution? • Will there be an environmental catastrophe? Why?
Fear	Of which future are you afraid?	• Will there be random acts of violence? • Do you think you can transform this future to a desired future? • Why or why not?
Hidden assumptions	What are the hidden assumptions of your predicted future?	• Are there some taken-for-granted assumptions (about gender, nature, technology or culture)?
Alternative futures	What are some alternatives to your predicted or feared future?	• If you change some of your assumptions, what alternatives emerge?
Preferred future	What is your preferred future?	• Which future do you wish to become reality for yourself or your organisation?
Next steps	And, finally, how might you get there?	• What steps can you take to move towards your preferred future?

Source: Adopted from Oberholster (2017) and Inayatullah (2013)

Table 2.1 is key in showing the areas of concern, which the basic futures question asked and the supporting questions. In analysing the ocean economy and developing scenarios for South Africa's ocean economy toward 2060, the researcher also explored the basic question as to what the future of the ocean economy would be. The researcher also explored supporting questions that unpacked the social, economic, technological and environmental drivers that were shaping the ocean economy. Other supporting questions also explored the steps that South Africa as a country could take towards the preferred future for the ocean economy that considered all six sectors highlighted in the Operation Phakisa Strategy (Department of Environmental Affairs, 2014).

2.4 FUTURES METHODOLOGIES AND TECHNIQUES

The forces of nature, social and political dynamics, scientific discovery and technological innovation largely determine the future. The purpose of futures methodology is to systematically explore, create and test both possible and desirable future visions (Inayatullah, 2007). Future visions can help generate long-term policies, strategies and plans, which help to bring desired and likely future circumstances in closer alignment (Glenn, 1994). Over the past six decades, a number of different methodological approaches and techniques have been developed to explore and imagine possible, probable, preferable and plausible futures. Krawczyk (2008) and Adendorff (2013) highlight that these approaches and methods are being constantly advanced as the new accelerating pace of change and increasing complexity and uncertainty pose new challenges for those involved in the study of the future. The words *method* and *technique* are used as substitutes, and they refer to individual methods such as the environmental scanning method, real-time Delphi technique, trend impact analysis, visioning and back casting (Oberholster, 2017).

As anticipation began to be used in the service of collective action, the need for rigorous tools arose naturally and humankind focused more attention towards considering the future (Glenn, 1994). To respond to these needs, foresight first exhausted the tools of operations research, then systems analysis, then strategy and, finally, it developed its own set of tools (Durance & Godet, 2010). Although foresight may be considered by some a soft science that remains isolated with no provision for rigorous tools, there is a need for rigorous methods to orient action towards a desired future (Warnke & Heimeriks, 2006). The toolbox of strategic foresight allows one to apply rigour to the foresight process by posing the right questions and reducing incoherencies, which often accompany group processes. Durance and Godet (2010) identify other tools, such as structural analysis for identifying the key questions concerning the future. Tools that have come to the aid of strategic foresight include stakeholder analysis to identify the influence of various stakeholders, morphological analysis to consider the entire field of possibilities and construct scenarios, expert analysis from real-time Delphi to assign probabilities and reduce uncertainty and multi-criteria analysis to identify and evaluate strategic options.

Creswell (2013) describes methodology as the researcher's strategy or plan of action that links the chosen methods to the desired outcomes, which need to guide the choice and the use of specific methods. In addition, a clear and relevant conceptual framework is also proposed by Inayatullah (2013) to guide the process of foresight creation. Inayatullah (2013) highlights the following four approaches, or types of futures studies, which are crucial for a thorough understanding of the future of the ocean economy:

- Predictive approach, which is based on empirical social sciences, and which assumes that the universe is deterministic, and that the future can be known.
- Interpretive approach, which is based on understanding competing images of the future; with insight rather than merely predicting the goal.
- Critical approach, which is based on asking critical questions about who benefits from the realisation of certain futures; with the aim not to predict, but rather to define the future.
- Participatory approach, where the future is constructed through deep participation (participatory-action learning).

It is also proposed by Inayatullah (2013) and Oberholster (2017) that different approaches can be used in a complementary manner. Various futures studies methodologies, concepts, and techniques were, therefore, integrated and applied throughout the research. The research effort was further guided by the following six concepts of futures thinking, as described by Inayatullah (2013):

- *Used future*. Have decision-makers and other stakeholders in South Africa purchased a used future, with their vision for the ocean economy borrowed from somewhere, or influenced by traditional approaches elsewhere?
- *Disowned future*. Is it the intention of decisions-makers in the ocean economy to focus more on shorter-term gains and strategic plans, and, by doing so, to ignore the development and other business opportunities offered by the ocean economy in South Africa?
- *Alternative futures.* This concept relates to the construction of a variety of alternative futures for South Africa's ocean economy towards 2060, and, by

doing so, to promote sustainable economic growth and inclusion in the sector, which is critical to facilitate the developmental role of the ocean economy.

- *Alignment.* This concept relates to the vision for South Africa's ocean economy and the day-to-day realities of key players in the industry, governments and coastal communities.
- *Models of social change*. Is the future of South Africa's ocean economy considered to be positive; and can it be influenced? This research was based on the belief in a positive future for South Africa's ocean economy that could be shaped and influenced by the actions of all regional and global stakeholders involved in the ocean economy.
- *Uses of the future.* This concept relates to the futures thinking that was applied in this research, which aimed to assist with the creation of more inclusive, sustainable and innovative developmental initiatives for South Africa's ocean economy. The aim of the research was to escalate the confidence of the ocean economy sector as one of the key contributors to economic growth and sustainable development, to generate preferred futures for an inclusive ocean economy in South Africa.

By understanding the used, disowned and alternative futures, key players in the ocean economy and the supporting institutions can become more innovative and proactive in creating the desired future for South Africa towards 2060 and beyond.

2.5 TYPOLOGIES OF FUTURE RESEARCH METHODOLOGY

From a focus on predicting the future, the modern discipline of futures studies has broadened to an exploration of alternative futures and deepened to investigate the worldviews and mythologies that underlie possible, probable and preferred futures (Inayatullah, 2008). Leedy and Ormrod (2010) and Creswell (2014) describe the research methodology as the holistic steps a researcher employs in embarking on a research work. Futures methodologies and techniques can be classified in many ways. From the broad literature, two main classifications arise, namely, explorative and normative as well as quantitative or qualitative (Adendorff, 2013; Oberholster, 2017).

2.5.1 Explorative and normative research

Explorative research methods are concerned with the exploration of possible futures, without regard to what is desirable, with both the present and the projected alternative futures as the starting point for explorative techniques (Krawczyk, 2008). The aim with explorative research was, therefore, to show different possibilities of what could happen in the scenarios for South Africa's ocean economy towards 2060 (Bizikova, Pintér, & Tubiello, 2014). Normative research methods, on the other hand, according to Krawczyk (2008), are based on values and wishes and they address the question, what future is desirable for South Africa's ocean economy? In normative research, the researcher first creates the image of the desired future through scenarios, and s/he then works backwards, to establish how this future could be achieved (Krawczyk, 2008). The aim with normative research, according to Bizikova et al (2014), is, therefore, to explore the preferred futures, and to show what a solution to a particular future problem might look like. These authors also argue that normative research methods are well-suited to explore the desired development requirements, the pathways and the adaptation needs relevant for different stakeholder groups (Krawczyk, 2008; Bizikova et al, 2014; Oberholster, 2017). This is further illustrated in Table 2.2 where the various methods used in future studies are named and categorised by technique from a qualitative and quantitative research approach and by purpose, looking at the explorative and normative nature of each method.

2.5.2 Qualitative and quantitative methods

Qualitative research is multimethod in focus, involving an interpretive, naturalistic approach to its subject matter. This means that qualitative researchers study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them (Leedy & Ormrod, 2010). On the other hand, quantitative methods involve mathematical calculations, which can operate on sets of real data (different variables and indicators) or may be based on assumptions opposite to reality (Adendorff, 2013). The research made use of both the quantitative and qualitative methods to analyse the ocean economy and establish causal links between contributory factors that were not necessarily known. The study was predominantly qualitative, and the quantitative data collected through the real-time Delphi platform was not used for generalisability.

Creswell (2013) classifies this type of research as a mixed-method study, as it involves collecting and analysing both forms of data in a single study. In a mixed-method approach, the researcher also tends to base knowledge claims on pragmatic grounds (for example, consequence-oriented and problem-centred), which allows them to both generalise the findings to a specific population and to develop a detailed view of the meaning of a phenomenon or concept for individuals (Oberholster, 2017). In Table 2.2, the various methods used within future studies are listed and categorised by technique in terms of the qualitative and quantitative research methodological approach.

2.5.3 Mixed methods

Mixed methods may be defined as “research in which the investigator collects and analyses data, integrates the findings and draws inferences using both qualitative and quantitative approaches or methods in a single study” (Tashakkori & Creswell, 2007:4). The philosophical underpinning of pragmatism allows and guides mixed methods researchers to use a variety of approaches to answer research questions that cannot be addressed using a singular method as is the case with the future of the ocean economy. Greene, Caracelli, & Graham (1989) identified five purposes for conducting mixed methods research designs. These include triangulation, complementarity, development, initiation and expansion. Bryman (2006) in a later review of 232 social science mixed-methods papers identified 16 reasons for conducting mixed-methods studies. Many of the rationales identified in Bryman’s (2006) analysis are similar to those identified by Greene et al (1989) although somewhat more detailed in manner. The main rationales or benefits proposed for undertaking a mixed-methods study include:

- Triangulation: this allows for greater validity in a study by seeking corroboration between quantitative and qualitative data.
- Completeness: using a combination of research approaches provides a completer and more comprehensive picture of the study phenomenon.
- Offsetting weaknesses and providing stronger inferences: many authors argue that utilising a mixed-methods approach can allow for the limitations of each approach to be neutralised while strengths are built upon thereby providing stronger and more accurate inferences (Bryman, 2006; Creswell 2013).

- Answering different research questions: Creswell and Plano Clark (2007) argue that mixed-methods research helps answer the research questions that cannot be answered by quantitative or qualitative methods alone and provides a greater repertoire of tools to meet the aims and objectives of a study.
- Explanation of findings: mixed-methods studies can use one research approach (namely, quantitative or qualitative) to explain the data generated from a study using the other research approaches. This is particularly useful when unanticipated or unusual findings emerge. For example, findings from a quantitative survey can be followed up and explained by conducting interviews with a sample of those surveyed to gain an understanding of the findings obtained.
- Illustration of data: using a qualitative research approach to illustrate quantitative findings can help paint a better picture of the phenomenon under investigation. Bryman (2006) suggests that this is akin to putting *meat on the bones* of dry quantitative data.
- Hypotheses development and testing: a qualitative phase of a study may be undertaken to develop hypotheses to be tested in a follow-up quantitative phase.
- Instrument development and testing: a qualitative study may generate items for inclusion in a questionnaire to be used in a quantitative phase of a study.

These points identify the usefulness that a mixed-methods research approach can have in answering a research question(s). However, it must also be noted that mixed-methods research may have more practical benefits in terms of promoting interdisciplinary research, which involves collaboration between various disciplines in a certain field as is the case with analysing six key sectors within the ocean economy and developing preferred scenarios for South Africa’s ocean economy.

2.5.4 Other classifications

In the past 20 years, a growth in participatory future studies was observed as well as the tendency to combine different approaches (Krawczyk, 2008; Ilbury & Sunter, 2010; Adendorff, 2013). Table 2.2 lists the most popular futures methods by technique and by purpose within the categories presented in Sections 2.5.1 and 2.5.2. Of the 19 methods listed, it can be deduced that most are qualitative in their technique and explorative in terms of purpose.

Table 2.2: List of popular futures methods by technique and by purpose

Table	BY TECHNIQUE		BY PURPOSE	
Method	**Quantitative**	**Qualitative**	**Normative**	**Exploratory**
Environmental Scanning	X	X	X	X
Cross Impact Analysis	X	X	X	X
Decision Analysis	X		X	
Decision Models	X			X
Delphi		X	X	X
Econometrics	X		X	X
Futures Wheel		X	X	X
Gaming and Simulation	X	X	X	X
Genius Forecasting		X	X	X
Morphological Analysis		X	X	
Participatory Methods		X	X	
Relevance Trees		X	X	
Scenarios	X	X	X	X
Statistical Modelling				X
System Dynamics	X			X
Structural Analysis		X		X
Technology Sequence Analysis		X	X	X
Trend Impact Analysis	X	X		X
Causal Layered Analysis		X		X

Source: Glenn (1994) and Krawczyk (2008)

Of the methods listed in Table 2.2, the researcher explored environmental scanning as a qualitative technique and for exploratory purposes to understand the Social, Technological, Economic, Environmental, Political, Legal and Ethical (STEEPLE analysis) issues shaping the ocean economy with specific focus on South Africa. Other methods that were applicable in this study, were scenarios and the causal layered analysis as they were key in the process of drafting preferred futures and used for the predominant qualitative nature of the study as well as the explorative approach in terms of developing and analysing scenarios for South Africa’s ocean economy.

2.6 RESEARCH APPROACH

Tactics and actions for a research study area are referred to as a research approach (Crowther & Lancaster, 2009). Three research study approaches cited in literature include the deductive approach, inductive approach and abductive approach (Collis and Hussey, 2003; Creswell, 2014). The abductive approach is the first stage of all interpretative processes and any scientific investigation (Saunders et al, 2017). The abductive approach implies looking for and exploring potential explanatory patterns within the facts of a phenomenon to reveal a path from facts to ideas and theory. Deductive, on the other hand, is based on theory or, more specifically, the theory’s hypotheses (Collis and Hussey, 2003; Creswell, 2014). It is possible to test and categorise the empirical facts with this approach in a more systematic and critical way than abductive consequences. However, the deductive approach cannot produce new hypotheses or assumptions since it is fundamentally self-referring, explaining relationship between variables as to test a theory (Collis and Hussey, 2003; Creswell, 2014). In an inductive approach, a new theory is formed based on research observation and empirical data from qualitative methods (Mertens, 2010). The research approach adopted in this study was the abductive approach as it best suited the research philosophy of pragmatism as it moves to and from and, in essence, combining both deductive that which is required at the beginning of any scientific research and inductive that which explores past studies from different perspectives (Collis and Hussey, 2003, Crowther & Lancaster, 2009; Creswell, 2014).

2.7 THE FUTURES STUDIES PROCESS

According to The Forward-Thinking Platform (2014), it is possible to not only anticipate and explore the future, but it is also possible to change it. Oberholster (2017) and Koekemoer (2019) further expand on Inayatullahs' (2013) description of the future studies process and its systemic nature in studying possible futures, including the worldviews and myths that underline each future. Future studies, according to the Inayatullah (2008; 2013) as well as The Forward-Thinking Platform (2014), over the past fifty years have, however, moved from predicting the future to mapping and shaping alternatives or desired futures. As a result, the move by The Forward-Thinking Platform (2014) has become an executive function that is key in guiding future business strategies.

As the ocean economy has inter-connected economic sectors that operate at regional and global scale, it is essential for members of the ocean business community to be able to identify the long-term opportunities and risks facing their operations worldwide and to take investment decisions accordingly (UNCTAD, 2012; OECD, 2016). Equally, it is in the vital interests of governments of coastal states and communities but also of many land-locked economies to understand the implications of an expanding ocean economy for the design and implementation of policies that shape the competitiveness of their national maritime industries and which affect the health of oceans within their national jurisdiction and beyond. Stakeholders in science, research and society, more broadly, have similar information requirements. Future studies and its methods are best placed to identify future issues, anticipate upcoming problems or opportunities and support decision making (Krawczyk, 2008; Inayatullah, 2015).

2.7.1 Research framework and the six pillars of future studies

The research framework for this research needed to consider the conceptual framework (see Section 1.8 in Chapter 1) on which this study was based. While a theory of the future is useful, a conceptual framework for understanding the future is essential. The conceptual framework for this research effort was based on the six pillars approach to future studies developed by Sohail Inayatullah (Inayatullah, 2013). The framework presents the step-by-step research process, the techniques and methodologies that were applied in the study, as well as the expected key outcome of each step.

2.7.7.1 Pillar One: Mapping the future

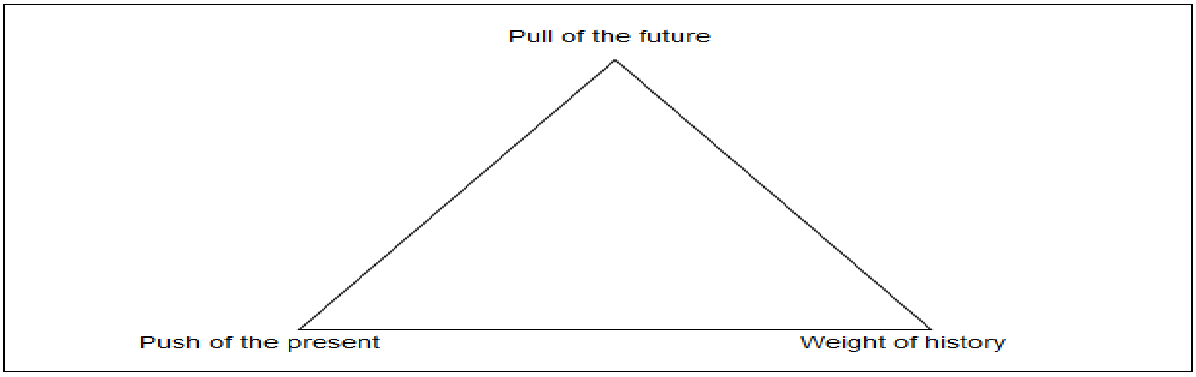
During this phase, an in-depth analysis was conducted to identify the different drivers that affected the ocean economy development and the growth needed for sustainability in the South African sector. Through mapping, the researcher identified the historical factors and patterns that had created the current *status quo* within the ocean economy. The present was mapped through a Social, Technological, Economic, Environmental, Political, Legal and Ethical (STEEPLE) environmental scanning process of the ocean economy.

In expanding on the environmental scan, a futures triangle was developed for the ocean economy, during which, the interaction between the following three forces were analysed, namely:

- Image of the ocean economy future that pulled industry players/ service providers and related stakeholders forward.
- Pushes of the present that had an intense impact on the ocean economy globally and in South Africa, which included issues such as urbanisation, declining economies, climate change, pollution to the ocean and growth prospects for the ocean economy.
- Barriers to change related to each of these future images, which might include perceptions in the reading of the risks associated with the ocean economy, regional and national capacities and other related institutional and regulatory factors.

The future of the ocean economy was thus mapped through these three dimensions. Figure 2.1 depicts the three forces, which, by analysing the interaction between them, helped develop scenarios for the development of South Africa’s ocean economy towards 2060. Both the environmental scan and the futures triangle formed part of the in-depth literature study, as presented in Chapters 4 and 5.

Figure 2.1: Futures triangle



Source: Inayatullah (2008)

The futures triangle assisted the researcher to analyse the interactions between images that promote sustainable ocean economy development, drivers that had an intense impact on the ocean economy and barriers and risks associated with a sustainable ocean economy future for South Africa.

2.7.7.2 Pillar Two: Anticipating the future

During the second phase, the information collected in the first phase was interpreted by applying the method of emerging-issue analysis. The key focus of this pillar was to identify possible trends and disruptions that might have a significant effect on growing a sustainable and an inclusive ocean economy in the future. The pre-emptive identification of these issues would allow governments, ocean industries, investors, researchers and other related stakeholders to respond pro-actively to emerging challenges, with the added benefit of triggering a search for new opportunities.

It was important for the researcher to note that emerging issues were high impact, low awareness issues with marginal data to support their development while trends, on the other hand, had significant supporting quantitative data (Inayatullah, 2013). Lastly, the future of the ocean economy was anticipated using the futures wheel as guided by Inayatullah's (2013) four steps, namely:

- Central trend or areas on which to focus would be established.
- Participants would come up with the primary impacts originating from the central trend.
- Each primary effect would have secondary impacts.

- Participants would explore the effects of primary and secondary impacts on the ocean economy.

2.7.7.3 Pillar Three: Timing the future

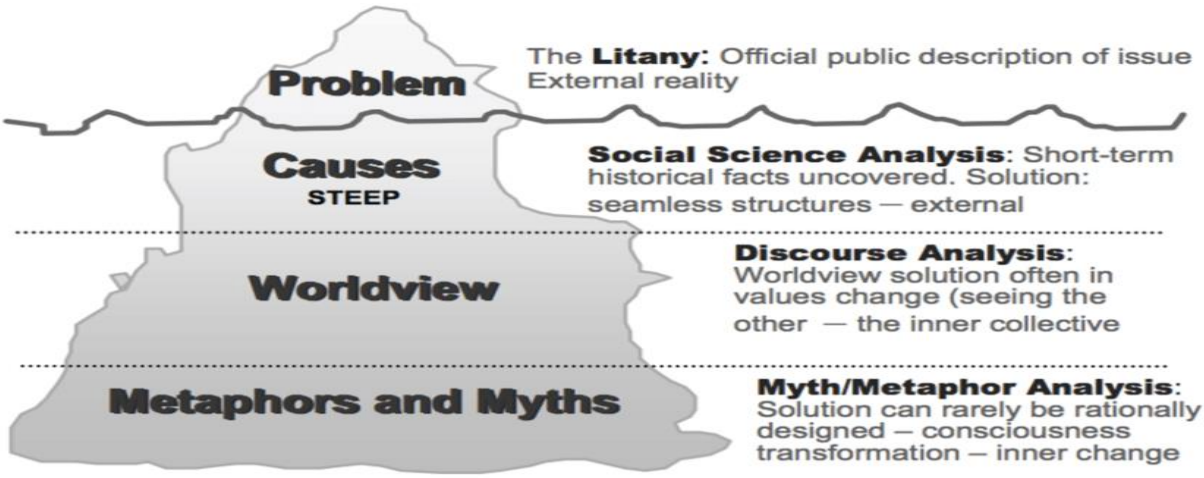
This phase would involve the search for the grand patterns of change, with a key focus on establishing the sources of change. It was important from a macro-history and a macro-historian perspective for the researcher to understand lessons that were crucial in understanding the deeper patterns of past, present and possible futures, represented as scenarios for the ocean economy. The identification of the sources of change in the ocean economy was guided by three main sources, as describe by Inayatullah (2013), namely:

- Change, which originated from how industry experts viewed the future of the ocean economy.
- Institutional change, which was usually achieved through taxation, legislation or incentives.
- Change, which originated from the use of new technologies.

2.7.7.4 Pillar Four: Deepening the future

During this phase, the research attempted to deepen the understanding of the future growth of the ocean economy by applying the method of causal layered analysis (CLA). CLA was used to ensure that the ocean economy strategies and identified patterns of change within the research were detailed and significant. Figure 2.2 shows the four dimensions or levels within CLA, namely, the litany, systemic, culture or worldview, and the myth or metaphor.

Figure 2.2: Causal-layered analysis pyramid



Source: Inayatullah (2013).

According to Inayatullah (2013), this phase of the research should attempt to integrate the four levels of understanding the ocean economy, namely:

- Litany, or the day-to-day future, or the commonly-accepted understanding of ocean economy development and the future thereof.
- Systemic, which is a deeper level of understanding that focuses on the multi-faceted nature of ocean economy development and the inclusive growth aspects thereof.
- Culture, or the worldview, which is the bigger picture or cognitive understanding of the way the delivery of ocean industry-related services to the ocean economy sectors is constituted.
- Myth or metaphor, or the deep unconscious story, which amongst other aspects, attempts to reveal the underlying pressure between sustainable development and ocean economy growth and the expected developmental role of the ocean economy.

Primary data collection for this pillar was conducted through the distribution of online questionnaires to global experts in the ocean economy using the real-time Delphi technique and conducting semi-structured interviews. The *deepening the future* phase also incorporated the application of a systems-thinking approach in research which, according to Senge (1990), has the ability to assist in understanding broader concepts within the ocean economy. The application of system methodology in futures studies is also supported by Peder and Bagheri (2006), who argue that any system in which humans are involved is characterised by high levels of uncertainty, limited predictability and evolutionary change. As a result of the presence of these characteristics, the authors argue that an adaptive approach to continuous learning and modification should be resorted to, which ultimately will enable decision-makers to improve the overall performance of the ocean economy (Senge, 1990; Peder & Bagheri, 2006).

2.7.7.5 Pillar Five: Creating alternative futures

During this phase, scenario planning was used to broaden the future by creating alternatives of different possible futures for the ocean economy. Various authors also support the use of scenario planning as a method to predict possible futures for complex environments like the ocean economy (OECD, 2016; Inayatullah, 2013).

The researcher also supported the use of scenarios planning and, in agreeing with Inayatullah (2013), the researcher identified scenarios as having multiple purposes and benefits for the researcher including:

- Allows researchers to gain a better understanding of chaos and complexities including the potential levers of influence.
- Allows researchers or organisations to understand the views of different stakeholders and perspectives.
- Offers new areas of growth, products, processes, people and possibilities.
- Helps clarify often hidden assumptions about the future.
- Assists the researcher in thinking about the unknown and to open up spaces for new action and reflection in the ocean economy.
- Enhances organisational learning capacity.
- Assists with reducing the risks and enhancing rewards identified for the future of the ocean economy.

2.7.7.6 Pillar Six: Transforming the future

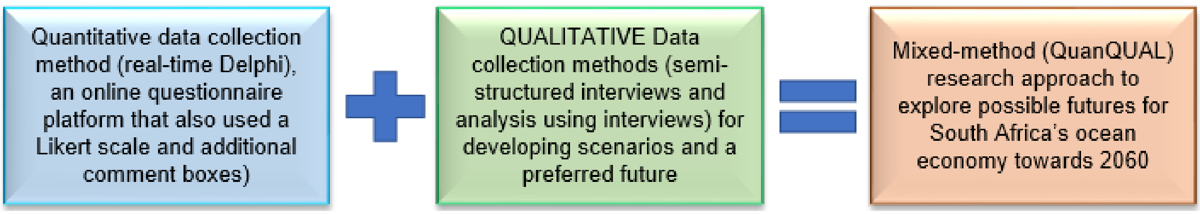
During the last phase, the futures was then narrowed to the preferred future for South Africa’s ocean economy towards 2060. This was achieved through a process of visioning and back casting. The visioning method had two approaches, namely, the analytical approach where participants wrote down characteristics of their preferred future and the creative visualisations, where participants visualised their preferred future (Krawczyk, 2008). Back casting as a method seeks to remove obstacles to creating desired futures by imagining that one has already created the desired future and what remains are the technical issues of determining the next steps (Inayatullah, 2015; Oberholster, 2017).

According to Inayatullah (2015), back casting is also especially helpful when win-win solutions are needed in cases where there is a conflict between visions of the preferred future for an inclusive ocean economy. To prevent this from happening, Inayatullah (2015) recommends that all the stakeholders construct the future of the ocean economy through deep levels of participation. In addition, Inayatullah (2013, 2015) also recommends a process of questioning, and the six basic futures questions that were recommended to assist in constructing the future for South Africa's ocean economy towards 2060 included:

- What do you think the future of the ocean economy will be like?
- Which future of the ocean economy are stakeholders afraid of?
- What are the hidden assumptions about the predicted future growth and sustainable nature of the ocean economy?
- What are some developmental alternatives to the predicted future of the ocean economy and what critical events will begin the path to the new future?
- What is your preferred or ideal future for South Africa's ocean economy?

This study was a sequential mixed-methods research that was predominantly qualitative and adopted certain quantitative approaches. Figure 2.3 clearly illustrates the study's specific research methodology.

Figure 2.3: Research study's sequential mixed-method diagram



Source: Researcher's own construction

Figure 2.3 diagrammatically represents the mixed-methods research approach best suited to capture quantitative and qualitative approaches, as the researcher did not want to miss any details or important details in the ocean economy.

In summarising the six pillars to future studies, it is important to note that the first two pillars focus on the creation of knowledge, followed by two pillars that focus on foresight with the last two pillars focusing on value creation (Inayatullah, 2008, 2013). Futures studies present a transformative foresight, vested in the six pillars and mixed methods that are linked. The use of mixed methods as demonstrated in the conceptual framework was key in following the six pillars of future studies and in responding to the complexities within the ocean economy. The mixed-method approach was most suitable for the research as its uses theory as a framework informing many aspects of design, including collecting, analysing and interpreting quantitative and qualitative data (Creswell, 2013).

2.8 SCENARIO BUILDING PROCESS

The fifth pillar of Inayatullah's six pillars of future studies is creating alternatives to the present. Key to this pillar is the development of scenarios. Scenarios are instruments for ordering people's perceptions about alternative future environments in which today's decisions might play out (Schwartz, 1991). The concept of scenario was first introduced in France by the French philosopher and futurist, Gaston Berger in 1964 as a *la prospective,* with the aphorism "acting at long term assumes that acting at long term means to understand the future, not to just imagine it" (Martelli, 2014: 61). Clem Sunter popularised the use of scenarios in South Africa with *The world and South Africa in the 1990s*, featuring the 'High Road' and 'Low Road' scenarios (Sunter, 1987; Claassen et al, 2014). In the relevant management literature, scenarios are now commonly referred to as alternative accounts of events still to happen, the simultaneous unfolding of different outcomes of a given situation (Kosow & Gaβner, 2008; Chermack, 2011; Martelli, 2014). Scenarios are rooted deeply in the reality of the current context and future studies through the six pillars approach by Inayatullah (2008), which allows for researchers to engage (critically) with existing facts of the situation. Wisdom-based scenarios introduce ethical futures to the equation, which provides the basis for understanding, bridging the gap of our decisions today, and the consequences for the future (OECD, 2006 and Saurin, 2012). The impact of decisions made today, and in the future, is a key theme in futures studies.

Scenarios are carefully constructed stories about the future. Each scenario represents a distinct, plausible, internally-consistent and challenging future world (Barbanente& Khakee, 2003, OECD, 2006, Saurin, 2012). It is widely agreed amongst futurists that scenarios do not aim to make predictions. Rather, their value lies in disturbing the present (Berger, 1999) to assist decision-makers in understanding the complex forces shaping the future.

Vervoort, Thornton, Kristjanson, Förch, Ericksen, Kok, Ingram, Herrero, Palazzo, Helfgott, Wilkinson, Havlík, Mason-D’Croz, and Jost (2014) highlight three challenges to the development and use of scenarios by decision-makers:

a) Ensuring the appropriate scope for action. Scenarios vary in spatial and temporal scale depending on their use. For national decisions, regional scenarios may need to be downscaled and revised to be relevant to the national context. The timescale may also be changed to reflect the timescale of particular policies, or may be used in conjunction with other scenarios, for example, global climate scenarios.

b) Moving beyond intervention-based decision guidance to a more embedded process whereby stakeholders are continuously engaged.

c) Developing long-term shared capacity for scenario planning. The scenario process is currently being strongly driven by research organisations and more focus needs to be put on building the capacity of decision-makers and their organisations to lead such processes and integrate them into daily decision-making practices

In mitigating against the three identified challenges by Vervoort et al (2014), the scenarios that was developed for South Africa’s ocean economy was country specific and for national decision-making purposes. The consultation process with the purposively-sampled participants was continuous. Despite the interviews being held once, the participants were informed and given the questions in advance for preparation and the finding of the study would be shared upon finalisation.

2.9 SAMPLING STRATEGY

According to Hsu and Sandford (2008), individuals are considered eligible to participate in a Delphi study if they have related backgrounds and experiences with regard to the issue/s under investigation. Hsu and Sandford (2008) also argue that the participants must be willing to reassess their initial judgements for the purpose of reaching consensus. The participants purposively sampled for both the qualitative and qualitative aspect of this research had related backgrounds and experience within the ocean economy. For both the quantitative and qualitative aspect of the research, a purposive sampling strategy was adopted for the real-time Delphi panel using a hybrid approach, where a maximum of 36 members were invited to the panel. These panellists included current real-time Delphi experts who had knowledge of the ocean economy. For the qualitative data aspect, semi-structured interviews were held with 12 participants in South Africa who are key role-players in the ocean economy.

The total number of targeted participants for the study was a minimum of 15 and a maximum of 50 participants for both the real-time Delphi and the semi-structured interviews. For the purpose of this research, the selection of participants was focused on industry experts in the field of ocean economy development and futures studies or strategic planning, with academics specialising in ocean-related industry and ocean governance globally and in South Africa. In addition, executive managers and decision-makers in the sectors linked to the ocean economy (namely, maritime transport, fishing and aquaculture, oil and gas exploration and marine tourism), who potentially might use the outcomes of the real-time Delphi study, were also be included as participants.

2.10 VALUES AND ETHICS IN FUTURE STUDIES

A fundamental question that has been raised in terms of values and ethics in future studies is, why should a futurist know the future better than anyone else? Such a position can only be sustained by a biased, *discipline-centred* standpoint according to which only the knowledge that comes internally from the discipline orthodoxy is acceptable. But since futures studies is not really attempting to know the future, it should accept that inputs from other disciplines, traditions or practices, which could be equally if not, sometimes, more valuable (Slaughter,1997).

According to Bell (2003), futurists are involved in a range of professions, such as teaching, researching, publishing, consulting and advising both governments and private organisations. This study acknowledged this responsibility and attempted to inform the decision-makers on the multi-dimensional impact of the ocean economy and how increased levels of sustainable practices and inclusion could improve the welfare of a significant portion of the South African population, both currently and in the future.

Although the absence of a comprehensive set of ethical guidelines in future research is acknowledged (Bell, 2003), validity and accuracy in the collection and reporting of information are highlighted by Geldenhuys (2006) as two key principles. The ethical principles that were required throughout the research included:

- Being open and attentive to new observations and discoveries, as part of the literature review.
- Ensuring truth would be presented honestly and without bias
- Requiring the participants to volunteer to participate in the research
- Informing potential participants, as fully as possible, on the nature and purpose of the research, their right to abstain from participation in the research, and the confidential nature of their replies
- Ensuring that the identity of the participants from whom information was obtained would be kept confidential

Research ethics and values are an integral part of any research project, institution or academic programme. In highlighting the research principles, the researcher aimed to display knowledge and awareness of what values and ethics in research were but also assure the reader that this research study was approached with the highest ethical norms and principles and all participants voluntary participated in the study without expecting a remuneration or favour from the researcher.

2.11 ACHIEVING RESEARCH RIGOUR

Sometimes it is necessary to invent data to complete a futures exercise. Unfortunately, invented data can be passed on to others as if they resulted from actual research. Responsible futurists cite data that is creatively created in such a way to prevent this problem, for example, different colours or fonts on charts, asterisks and footnotes, or clearly stating so in text (Glenn, 1994; Bell, 2003; Krawczyk, 2008; Adendorff, 2013 and Oberholster, 2017). Cornish (2004) confirms that futures studies do not pretend to have the ability to exactly predict the future, but the focus is rather on giving more clarity regarding the future, and to empower decision-makers to take advantage of any opportunities that may exist. To address research rigorously or reliability and validity issues, the author ensured that the research did not start with the assumption that the research objects of futures studies and scenario development could be isolated from their environment; and further proposed a collaborative process to integrate the research objects.

In proposing scenarios for South Africa's ocean economy, pillar four of the six-pillars conceptual framework approach of Inayatullah (2013), a research method was needed to validate and prioritise the trends and the potential disruptors that would emerge from chapter 5 of this research. It is for this purpose that the real-time Delphi method was employed to check the future importance of the identified megatrends, key drivers and wild cards in the ocean economy. In addition, the real-time Delphi method also intended to investigate the future perspectives of experts and to identify any specific promising technological areas, innovations and trends that could be used to shape and inform a sustainable future for South Africa's ocean economy towards 2060.

The Delphi method, developed at the RAND Corporation in Santa Monica, California (Gordon, 2009), was introduced in the 1950s as a solution to address the inefficiencies generally associated with traditional group meetings (Green, Armstrong & Graefe, 2007). The method is designed as a group-communication process (Day & Bobeva, 2005; Hsu & Sandford, 2008), which, according to Markmann, Darkow and Von der Gracht (2013), is useful to solve real-world issues in a collaborative manner. The Delphi technique is particularly suitable for complex issues where the outcome is not dependent on the sample size of the participants, but rather on the different perspectives and expertise of participants and their indirect group interactions (Mukherjee, Huge, Sutherland, McNeill, Van Opstal, Dahdouh-Guebas & Koedam, 2015). The Delphi technique is thereby best compared to approaches commonly used in group decision-making such as nominal group technique, focus group discussions, prediction markets or statistical aggregation. It, therefore, has become a widely-used and generally-accepted method for collecting data from the participants within their domain of expertise. This, according to Mukherjee et al (2015), motivates independent thought, promotes different perspectives and avoids [the] gradual formation of group solutions. On the other hand, the conventional Delphi method, according to Gnatzy, Warth, Von der Gracht and Darkow (2011), has certain weaknesses. The weaknesses include complicated facilitator tasks, lack of real-time presentation of the results, and difficulties in tracking progress over time. To overcome these inherent weaknesses, Gnatzy et al (2011) propose the use of the real-time Delphi method, with the following advantages highlighted:

- Increases the efficiency from a process perspective (the participants receive immediate feedback after their responses, without any need for having sequential rounds).
- Accommodates expert availability, and it also allows experts to participate, regardless of their physical location and reduces the drop-out rates.
- Allows experts to dedicate fewer resources for participating in the process as there is no necessity to physically bring a group of experts together. This is also supported by Diab and Abdel-Ghany (2014), who describe the real-time Delphi method as an inexpensive research methodology that involves experts, without physically bringing them together.

In addition, the following four main characteristics of the Delphi method are also inherent when using the real-time Delphi method (Hsu & Sandford, 2008; Gordon, 2009; Gnatzy et al, 2011):

- Ensures anonymity of the participants, which promotes and maintains confidentiality throughout the process
- Reduces the effects of dominant individuals
- Prevents group-thinking (Campos-Climent et al, 2012)
- Provides an immediate and controlled-feedback process
- Uses statistical aggregation of the group responses to ensure that the opinions generated the by participants are well-represented in the final iteration
- Includes multiple iterations, which usually result in the participants becoming more problem-solving-oriented when offering their opinions or judgements

Reliability and validity are conceptualised as trustworthiness, rigour and quality in a predominantly qualitative paradigm. This can be achieved by eliminating bias and increasing the researcher's truthfulness of a proposition about some social phenomenon using triangulation. The qualitative researchers use a combination of strategies from the list of following ten recommended by McMillan and Schumacher (2006). Stenbacka (2001) as well as McMillan and Schumacher (2006) agree that triangulation is a typical strategy for improving the validity and reliability of research or evaluation of findings. For mixed-methods research, Creswell (2013) describes that by triangulation, a researcher uses different data sources of information and examines evidence from the sources to build a coherent justification for themes. The six pillars conceptual framework to future studies ensures that different data sources of information are collected and examined to develop and analyse scenarios for the ocean economy towards 2060.

Table 2.3 outlines the research process followed in relation to the six pillars and the various areas that were covered within the various steps.

Table 2.3: Research process outline in relation to the six pillars

STAGE 1: Presenting ocean economy literature, the thinking and future implications	
Step 1: Identifying the problem and unpacking the future study research methodology	Identifying the research problem as well as research aims and objectives
Step 2: Reviewing literature	Selecting relevant research articles and books published on the ocean economy and scenario development (Pillar 1)
STAGE 2: Identifying key trends and investigating the grand patterns of change in the ocean economy	
Step 3: Conducting a sequential mixed-methods research (Quan + QUAL)	Using the real-time Delphi tool to collect Quan and QUAL data for the study (purposive sampling using experts locally and internationally) (Pillars 2 and 3)
Step 4: Confirming megatrends in the ocean economy	Using real-time Delphi results to confirm the identified megatrends (Pillar 4)

STAGE 3: Broadening the future of the ocean economy through alternatives	
Step 5: Implementing scenarios planning process	Using CLA to ensure that the ocean economy scenario and identified patterns of change within the research were deep. A scenario planning process, informed by the identified megatrends, was used to create four plausible scenarios that were used to understand and manage the uncertainties that come with developing the ocean economy (Pillar 5)
Step 6: Developing a preferred future for South Africa’s ocean economy towards 2060	Using the literature review, results from real-time Delphi and semi-structured interviews for the ocean economy visioning exercise for South Africa towards 2060 (Pillar 6)
Step 7: Summarising and concluding	Drawing conclusions and making recommendations

Source: Researcher’s own construct.

2.12 SUMMARY

Over the past six decades, futures studies have developed in both depth and breadth. It is a globally distributed meta-discipline, and its collection of concepts, methods and findings are applied extensively in the areas of business, environmental studies and development studies. Chapter 2 was key in presenting the significant role future studies play in attempting to identify future issues, anticipate upcoming trends, problems or opportunities and support decision-making. The chapter also showed that most future studies are mixed methods and this future study also used a sequential mixed-method research approaches (quantitative and QUALITATIVE = quanQUAL) to explore futures for South Africa's ocean economy towards 2060. Chapter 3 presents the global ocean economy perspective literature review section and provides a global and regional perspective on the ocean economy, its challenges and implications for sustainability and economic development.

CHAPTER THREE

OCEAN ECONOMY AND THE GLOBAL CONTEXT

3.1 INTRODUCTION

In Chapter 2, the research methodology was discussed and presented. Chapters 3 and 4 of this research study focuses on pillar one and pillar two of the six-pillar approach of Inayatullah (2013), namely, mapping the future and anticipating the future. The key objective is the creation of knowledge on the ocean economy, the future drivers and trends key for the ocean economy as well as the six sectors identified as significant for the growth of South Africa's ocean economy towards 2060. The chapter starts with section 3.2 and 3.3 which focus on the global development agenda and the developmental role of the ocean economy within the global agenda. Section 3.4 and 3.5 of the chapter then presents an overview of the ocean economy, the various capitals that underpin the ocean economy and the strategic role of the sector in economic development.

3.2 GLOBAL DEVELOPMENT AGENDA

OECD (2012) cites that by 2050, an extra 2 billion people at least will need to be fed, raising the demand for fish and other marine foods from fisheries and aquaculture. As consumers, they will stimulate sea-borne freight and passenger traffic, shipbuilding and marine equipment manufacturing, as well as exploration for offshore oil and gas reserves. Ageing populations will continue to target coastal locations for holidays, cruise tourism and other leisure and entertainment related activities (World Tourism Organisation, 2001, Visbeck et al 2017). Further, research cites the major challenge for the future of life on this planet as achieving a species of development that increases wealth and reduces poverty while sustaining the natural resources (United Nations, 2008; Visbeck et al, 2017; Global Sustainable Development Report, 2019).

The challenge of sustaining natural resources has been taken up and institutionalised in the framework of the United Nations (UN) *Agenda 21. Further to Agenda 21,* an action plan for achieving sustainable development in the 21st century was developed. It was a major outcome of the UN Conference on Environment and Development in Rio de Janeiro in 1992. The 2015, Paris Agreement on Climate Change and UN

Sustainable Development Goals (SDGs) both recognised the vital role oceans play in climate and economies as well as the need to alleviate the pressures on them (OECD, 2016; IPCC, 2019). SDG 14 on oceans, and its associated targets, sets out a much-needed ambition for change by 2030 (G20-Insights, 2017). The challenge was affirmed, and further elaborated upon at the subsequent conferences devoted to this topic. To accelerate the still rather slow progress being made in achieving sustainable development at the global level, the recent UN Conference on Sustainable Development in 2012 (*Rio+20*) produced a document called, *The Future We Want G20-Insights.* The document not only emphasises the need for action but also agrees on a set of measurable SDGs to support focused and coherent action in priority areas at the global level (United Nations, 2015).

SDG14 focuses on human interactions with the ocean, seas and marine resources. It is underpinned by targets addressing conservation and sustainable use of the ocean, seas and marine resources including coastal zones and targets referring to capacity building and ocean governance (Unger, Müller, Rochette, Schmidt, Shackeroff & Wright, 2017). SDG17, which focuses on partnerships, is an important building block for the 2030 Agenda, aimed at strengthening the means of implementation for all SDGs. Global partnerships for sustainable development are especially important in the context of oceans, seas and marine resources, owing to the global connectivity of marine ecosystems and the cross-cutting and often far-reaching effects of marine resource use (G20-Insights, 2017). Achievement of SDG14 will benefit particularly from the mobilisation of financial aid, strengthened technology exchange, capacity building, and better policy coherence and multi-stakeholder partnerships (Unger et al, 2017:42, UNCTAD, 2018).

3.3 THE 15 GLOBAL CHALLENGES AND THE OCEAN ECONOMY

The 15 Global Challenges provide a framework to assess the global and local prospects for humanity (The Millennium Project, 2015. As the identified 15 challenges are interdependent, an improvement in one makes it easier to address others. On the other hand, deterioration in one makes it harder to address others. All 15 challenges are all equally important and arguing whether one is more important than another will be like arguing that the human nervous system is more important than the respiratory system (The Millennium Project, 2015). Sections 3.3.1 to 3.3.15 briefly discuss the 15 global challenges in relation to the ocean economy and how each challenge affects the sector on a global scale.

3.3.1 Addressing global climate change and sustainable development

Sustainability issues are of growing concern in the world, as the effects of human activities on the planet become more visible (Wasim, Hasan and Nine, 2017). The Sustainable Development Goals Report (2019) identifies climate change as the defining issue of the present time and the greatest challenge to sustainable development. Global climate change and the impact on the oceans have also received greater attention as The United Nations Environment Program (2012) in its report under the rubric of 'Green Economy in Blue World' compares the resources of ocean as *cornucopia* for human civilisation. Here, the term cornucopia is a Greek mythical lexicon that refers to cone-shaped ornament, which is abundant with whatever its owner desires (UNEP, 2012). Hence, there has been brewing global concerns for preservation and sustainable utilisation of ocean resources (Wasim et al, 2017).

The oceans play a vital role in terms of ecosystem functionality, natural resource provision and regulating the earth's climate (Wasim, Hasan and Nine, 2017; Walker, 2018). The oceans also regulate the global climate by mediating temperature, driving the weather and determining rainfall, droughts and floods (World Wildlife Fund, 2016). The oceans are also the world's largest store of carbon, where an estimated 83% of the global carbon cycle is circulated through marine waters (IPCC, 2013; World Wildlife Fund, 2016). But the interaction between these two natural forces is altering, and the exchange is intensifying. The consequences of this is being seen around the world. In the last 200 years, the oceans have absorbed a third of the CO_2 produced by human activities and 90% of the extra heat trapped by the rising concentration of greenhouse gases (IPCC, 2013). As the climate responds to decades of increasing carbon emissions, the store of energy and heat from the atmosphere builds up in the ocean. If a tipping point is reached, more extreme weather events, changing ocean currents, rising sea levels and temperatures as well as the melting of sea ice and ice sheets will be experienced, all of which will aggravate the negative impacts of overfishing, illegal fishing, pollution and habitat degradation (IPCC, 2013; Fussel, 2007:13).

At the front line of climate change, the ocean, the coastlines and coastal communities are being disproportionately impacted by increasing carbon dioxide (CO_2) and other greenhouse gas (GHG) emissions from human activities (IUCN, 2015). The ocean plays a central role in regulating the Earth's climate. The Fifth Assessment Report published by the Intergovernmental Panel on Climate Change (IPCC) in 2013 revealed that the ocean has thus far absorbed 93% of the extra energy from the enhanced greenhouse effect, with warming now being observed at depths of 1,000 m. Consequently, this has led to increased ocean stratification (prevention of water mixing owing to different properties of water masses), changes in ocean current regimes, and expansion of depleted oxygen zones (IPCC, 2013). Changes in the geographical ranges of marine species and shifts in growing seasons as well as in the diversity and abundance of species communities are now being observed (IUCN, 2015). At the same time, weather patterns are changing, with extreme events increasing in frequency. Atmospheric warming is leading to the melting of inland glaciers and ice, causing rising sea levels with significant impacts on shorelines (coastal erosion, saltwater intrusion, habitat destruction) and coastal human settlements. The IPCC (2013) projects global mean sea level to increase by 0.40 [0.26-0.55] m for 2081-2100 compared with 1986-2005 for a low emission scenario, and by 0.63 [0.45-0.82] m for a high emission scenario.

In the face of climate change and the ocean economy, it is of vital importance to identify both the factors that make society vulnerable and how society can physically and socially adapt (Adger, Arnell & Tompkins, 2005; Fussel, 2007; OECD, 2016). The potential of the oceans to meet sustainable development needs is enormous; but only if they can be maintained in and/or restored to a healthy and productive state. The importance of oceans for sustainable development has been recognised from the beginning of the United Nations Conference on Environment and Development (UNCED) process, in Agenda 21, the Johannesburg Plan of Implementation and reaffirmed in the outcome document of the Rio+20 Conference (G20-Insights, 2017). However, ongoing trends of exploitation and degradation of marine and coastal ecosystems show that endeavours to date have been insufficient and that more needs to be and must be done (UNCTAD, 2012). Protecting and restoring oceans in changing climates requires a range of strategies. These, among others, include ecosystem-based approaches, integrated coastal management and significantly expanding marine protected areas (IUCN, 2015; OECD, 2019).

3.3.2 Providing sufficient clean water without conflict

The water supply crisis is identified by industry, government, academia and civil society as one of the top global risks (World Economic Forum, 2013). Over 1.7 billion people live in river basins where water use exceeds recharge (Drieschova, Giordano & Fischhendler, 2008; OECD, 2012). Ocean water desalination projects are very expensive, rivers are drying up and groundwater is becoming depleted. Decision-makers and managers at all levels face growing challenges in satisfying increasing, often conflicting demands from stakeholders. As countries develop and populations swell and urbanise, demand for water to provide energy, food and industrial goods is projected to increase by 55% by 2050 (Feitelson, 2000; OECD, 2012).

Many countries are dependent upon water that originates outside their borders (Drieschova et al, 2008). In fact, basins shared by more than one country cover almost half of the Earth’s land surface (UNEP, 2002) and often require regulative frameworks to coordinate riparian’s actions. The dependence and sharing among countries on the limited water resources also pose limitations and challenges for the ocean economy. Research by (Schupp, Bocci, Depellegrin, Kafas, Kyriazi, Lukic, Schultz-Zehden, Krause, Onyango and Bela; 2019) confirm that maritime powers still show more interest on securing national resources rather than on promoting international cooperation for secure trade and sustainable exploitation of marine resources. In fact, transboundary water management rules regulating the allocation of shared waters are a widely discussed topic and represent one of the most controversial aspects of treaty negotiations among countries (Feitelson, 2000; United Nations, 2015). The codified inflexibility in allocation has been cited as one factor behind the failure of agreements to withstand variability shocks. Other allocation mechanisms, such as flow percentages, have been advocated as an alternative (United Nations, 2015; Visbeck et al, 2017). Developing formalised communication between parties through the establishment of, for example, joint management institutions can overcome the rigidity of water treaties and serve as a venue for solving water conflicts (United Nations, 2015). Establishing conflict resolution mechanisms and encouraging data exchange are two other means through which communication channels can be established

(Schupp et al, 2019). Conflict resolution mechanisms provide an agreed forum for the discussion of changes in resource conditions not envisioned within initial agreements.

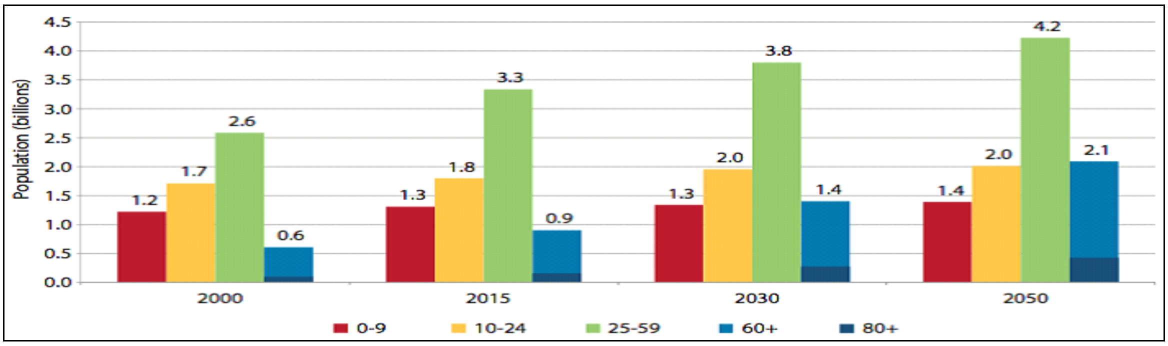
UNDP's work on Water & Ocean Governance focuses primarily on the challenges related to SDG 6, namely, sustainable management of water and sanitation for all, and SDG 14, to conserve and sustainably use the oceans, seas and marine resources (UNDP, 2015). Water remains central to development and climate change as a result, if climate change results in significant sea level rise, 20% of the world's coastal freshwater may become saline (The Millennium Project, 2015, World Bank, 2018). This will result in people seeking desperate attempts to cope and end up using massive amounts of diesel to produce desalinated water, contributing further to CO_2 emissions. Investments in improving water supplies, such as physical infrastructure are insufficient to meet present and future water demands and the need is projected to increase over the next century (World Bank, 2018). The UNDP (2015) and Schupp et al (2019) suggest that investments in improving water governance and developing capacity to better manage both water supply and demand remain equally important for the current and future generations.

3.3.3 Balancing population growth and resources

By the year 2030, the United Nations projects that world population will have grown beyond its present numbers by anywhere from 1.4 billion to 2.8 billion human beings (United Nations, 2012b). The global urban population is projected to grow by 2.5 billion urban dwellers between 2018 and 2050 as shown in Figure 3.1, with nearly 90% of the increase concentrated in Asia and Africa (United Nations, 2019). In many regions, the share of population living in cities, as well as the number and size of cities, will continue to grow, driven by a combination of factors, including a surplus of births over deaths in urban areas, migration from rural to urban areas and from abroad as well as the urbanisation of formerly rural areas (Neumann, Vafeidis, Zimmermann, Nicholls, 2015; World Bank, 2018; United Nations, 2019). Even at the low end of this range, the increase in food demand over the next three decades will be unprecedented in human history and, more so, if much-needed progress is not made to reduce the malnutrition that now weakens some 800 million human beings (OECD, 2012). While, in general, world population growth is slowing down, in some region's population will continue to expand well beyond 2050 and even into the next century (United Nations Development

Programme, 2017). More people now reside in cities than in rural areas, and this discrepancy is projected to increase as population grows. Figure 3.1 shows the global population by broad age group, from 2000 and estimated up until 2050 (United Nations, 2015).

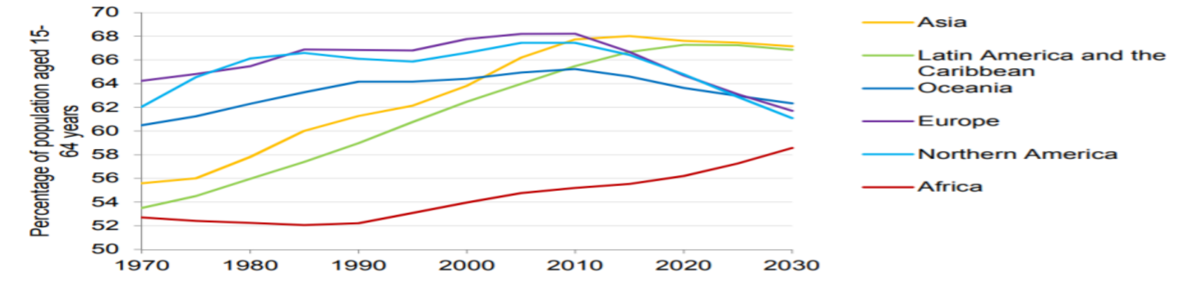
Figure 3.1: Global population by broad age group (2000-2050)



Source: (United Nations, 2015).

Figure 3.1 shows the global population dynamics in billions up to the year 2050. It is important to note that in the year 2050, ten years before the proposed prognosis for South Africa's ocean economy towards 2060, the largest population group in the world will be made up by the 25-59-year age group (United Nations, 2015). In analysing population growth and resources, with specific focus on ocean economy resources, it is important that the population by region is considered and that the age group is also highlighted that will be more susceptible to use the ocean and the resources that it offers (Neumann et al, 2015). Figure 3.2 shows that in some parts of the world, notably Africa, populations are still young, and the projections are showing an increasing trend towards 2030, which provides an opportunity for a demographic dividend and enhanced economic productivity (United Nations, 2015). The population projections present areas for exploring on the ocean economy towards 2060 (namely, a younger population might have a rising demand on fisheries, energy sources and skills as well as research on innovation and technology in the ocean economy space).

Figure 3.2: Percentage of population aged 15-64, by region (1970-2030)



Source: United Nations (2015).

Figure 3.2 shows a percentage of the world population prospects per region for the 15-64-year-old age group between the years 1970 and 2030. Africa shows a rising percentage from the year 1990 leading up to 2030. What these projections signify for the ocean economy is that the largest population group in the world will be coming mainly from the African continent. It is important, therefore, to consider what the implications will be for South Africa, which is one of the largest ocean economies in the continent. Urbanisation has been accompanied by a transition in dietary patterns, which has had a great impact on food systems. Marine fish provides 15% of all animal protein consumed by humans. Under this intense pressure, 15% of 7.5 billion people (and growing) each year, year in and year out, global fisheries are under threat (OECD, 2012; WWF, 2015a). With more than half of the world's people living in urban areas (55%, up from 30% in 1950), urbanisation determines the spatial distribution of the world's population and is one of the four demographic megatrends, with the growth of the global population, population ageing and international migration (United Nations, 2019).

Around 75 million people, or 1.3% of the world's population, live within the three major tropical wilderness areas, namely, Upper Amazonia and Guyana Shield, the Congo River Basin, and the New Guinea-Melanesia complex of islands (Cincotta & Engelman, 2000). All together, these areas cover around 6% of Earth's land surface. Population in the tropical wilderness areas is, on average, growing at an annual rate of 3.1%, which is over twice the world's average rate of growth, and is a product of rapid migration and high rural fertility rates in these regions (Cincotta & Engelman, 2000). According to the United Nations' Department of Economic and Social Affairs, Population Division (2019), in most hotspots located in developed countries, populations are projected to grow for several decades to come. Past and present migration into these areas is the major factor in this continued growth, specifically in the US states of California, Florida and Hawaii as well as in Western Australia and New Zealand. Much of the migration in the US states is internal, with more people moving to warmer climates and coastal areas and similar migration patterns have been reported in other parts of the world (Cincolta & Engelman, 2000; United Nations, 2019).

Cincolta and Engelman (2008:38) conclude, "What is exciting about the state of the world's population is not the certainty about its future direction—there can be none—but the clarity of its present trends. At a time of rising concern about mass extinctions of wild species and the loss of natural ecosystems, it can only be good news that humanity's growing". The demand for food and for basic shelter, in relation to the ocean and its resources, tends to closely parallel human population growth (OECD, 2012; World Bank, 2018). For a country to meet these basic needs using its own natural resources, it must experience development sprawl or intensification, and most often some combination of the two (McNeely & Ness, 1996). Each response can have dramatic consequences for biological diversity especially in relation to the ocean economy as 60% of the global population reside within coastal areas (OECD, 2012). Imports and exports of food also affect the scale of demand directly impacting on transportation networks, economic productivity, affluence and public policies, which will tend to shape the geographic patterns of housing and urban growth, especially those within coastal areas.

3.3.4 Ensuring genuine democracy from authoritarian regimes

As cited by the Freedom House (2019), the end of the Cold War accelerated a dramatic wave of democratisation began as early as the 1970s. The fall of the Berlin Wall in 1989 and the Soviet Union's collapse in 1991 cleared the way for the formation or restoration of liberal democratic institutions not only in Eastern Europe, but also in the Americas, sub-Saharan Africa and Asia. Reports from the Freedom House (2019) show that between 1988 and 2005, the percentage of countries ranked *not free* in *Freedom in the World* dropped by almost 14 points (from 37 to 23%), while the share of free countries grew (from 36 to 46%). This surge of progress has now begun to roll back. Between 2005 and 2018, the share of not free countries rose to 26%, while the share of free countries declined to 44% (Freedom House, 2019). Annual figures, in line with population trends, depict that currently more people vote as compared to historically. The Millennium Project (2015) reports that although democracies are growing while dictatorships are decreasing, there are approximately 50 failed nation-states. Democracy is a mental attitude and a habit of behaviour as well as responsible governance that protects group and individual rights and assures opportunity for meaningful participation in the political process (The Millennium Project, 2015).

Democracies are on average richer than non-democracies and are less likely to go to war and have a better record of fighting corruption (The Millennium Project, 2015). Contrary to the point made by Kolstad and Wiig (2011), where they identified the causal impact of democracy on corruption by using an instrument based on the conflict history of countries. From a theoretical perspective, there are several reasons why democracy might be expected to reduce corruption which remains a key area if countries are to promote and maintain sustainable development (Kolstad & Wiig, 2011). Elections increase the probability that corrupt officials will be exposed and punished, as the opposition has an incentive to uncover corrupt activities by the incumbent, and voters have an interest in not re-electing politicians that favour their own private interests over those of the electorate. Moreover, competitive elections likely drive down the private rents that can be appropriated by officials, since offers of favourable treatment for special interests can be undercut by the opposition (Sorenson, 2012; Nightingale, 2015). Democracy can also entail a more open system of government, which means that private information on how the system works will become less prevalent, and information rents will go down. Effective checks and balances within government may similarly constrain the ability of officials to deviate from impartial practices. In other words, knowing someone in power becomes less valuable. Furthermore, democracy may affect the normative perceptions of corruption in a society, making corrupt activities less appealing as they carry a greater stigma, and possibly also affect the type of individuals attracted to public office. In sum, democracy may reduce corruption by reducing private benefits of corrupt actions and increasing expected costs (Kolstad & Wiig, 2011).

Although reports from the Freedom House (2019) conclude that freedom and democracy continued to make overall progress worldwide in 2003 (25 countries demonstrated forward progress in freedom, while 13 registered setbacks). The organisation also found that press freedoms decreased in 2002 (73 were rated free, 49 partly-free, and 71 not free compared with 78, 47 and, 68 respectively in 2001) and that the number of electoral democracies declined from 121 to 117. Nevertheless, democratisation is a global long-term trend. Since democracies tend not to fight each other, and since humanitarian crises are far more likely to occur within authoritarian regimes, the trend toward democracy should lead to a more peaceful future (Freedom House, 2019). Unfortunately, people can lose their incomes and social status during transitions to democracy. New democracies must address previous abuses of power to earn citizen loyalty, yet the pursuit of this justice can increase social discord and slow the process of reconciliation and democratic transition. Some recent democracies have not consolidated their democratic institutions and cultural changes; hence care has to be taken to prevent elected democracies from becoming tyrannies. To become genuine, young democracies emerging from authoritarian regimes need long-term economic stability, some experience with pluralism, and a majority of pro-democratic actors. Dramatic changes like multiparty elections, a free press, written constitutions, legal reforms, and an independent judiciary do not automatically create a culture of democracy with citizen responsibilities.

The internet has also increased the opportunity for citizen feedback on public issues through e-government and other electronic means. As a result, governments are expected to become more accountable, transparent and responsive to their citizens. Yet increasing sophistication and interaction among information technology, marketing, competitive intelligence, organised crime, and the potentials of information warfare raise the potential for the manipulation of information. Freedom of choice, inherent to democracy, implies judgement based on reliable information. Hence the development of methods to counter information manipulation will be important for continued democratisation in the future (Freedom House, 2019). Democracy also needs strong rules against corruption and a smaller gap between rich and poor. Submission by the most powerful democracies to international law and transnational bodies is essential if democracy is to retain credibility in the eyes of people who have no direct experience with it. More fundamentally, democracy allows people speak their minds and shape their own and their children’s futures (The Economist, 2014). What genuine democracy from authoritarian regimes implies for the ocean economy is the fact that businesses and citizens in coastal areas or part of the ocean economy are able to benefit from well-managed resources, they can influence the future of the industry and ensure that conflicts or challenges around resource and environmental sustainability are minimised as freedom and democracy continue to make overall progress worldwide. With freedom of choice-inherent to democracy, this implies judgement within the ocean economy and anti-participation therein will be based on reliable information and governance structures.

3.3.5 Ensuring policymaking and sensitivity towards global long-term perspectives

Decision-makers are rarely trained in foresight and decision-making, even though decision support and foresight systems are constantly improving, for example, big data analytics, simulations, collective intelligence systems, indexes and e-governance participatory systems (The Millennium Project, 2015). The use of strong analytical frameworks and tools, in most cases models, can facilitate the development of robust and comprehensive long-term perspectives on ocean economy development. Models, as simplified representations of reality, are key to long-term policy formulation, and implementation in the near-term, is consistent with a country's socio-economic development priorities. It is nearly impossible to deal with the reality of developing and implementing these long-term strategies owing to all the complexities that come with this. Models are, therefore, used to simplify these complexities to generate some understanding (Buehring and Liedtka, 2018). For example, in establishing a baseline reference for projecting future policies and implementation options in specific sectors, developing monitoring and reporting indicators, models can be very useful.

Policymaking is usually described as a cyclical process, from problem identification to programme evaluation, which, in turn, informs the next round of policy design (The Millennium Project, 2015; Buehring and Liedtka, 2018). While unexpected events mean that policymaking is sometimes sporadic and reactive, governments also face demographic, economic and environmental challenges, which extend beyond the short-term, and often demand global solutions (Buehring and Liedtka, 2018). In this light, many public administrations are finding the time and space for forward policy planning over medium long-term horizons, covering more than one electoral cycle (United Nations, 2013). Policy makers are also increasingly looking to actively involve citizens and businesses in policy-making, rather than as the passive recipients of policy decisions which is very key for complex environments like the ocean economy (OECD, 2016; FAO, 2017).

Government policy can help create, strengthen, sustain and expand the ocean economy and associated maritime industry clusters. But there is no one-size-fits-all policy approach, and much depends on local and national circumstances. Considering the focus on developing ocean economies and sustainability, there has been a significant increase in the number of countries and regions putting in place strategic policy frameworks for better ocean management within their Exclusive Economic Zones (EEZs) (OECD, 2016). However, given the acceleration expected in the use of the ocean and its resources over the coming years, it will be essential to step up both the effectiveness and the geographic spread of integrated ocean management around the world. Many coastal nations have already introduced a mix of sector and industry-specific policies for economic activities in the ocean, and increasingly countries have undertaken efforts to develop more integrated policies reflecting the underlying ecosystems, including coordinating the actions of various government agencies (OECD, 2016). It is in the vital interests of governments of coastal states, and also of many land-locked economies to understand the implications of an expanding ocean economy for the design and implementation of policy. These policies shape the competitiveness of their national maritime industries and which affect the health of oceans within their national jurisdiction and beyond (Visbeck et al, 2017).

3.3.6 Developing global convergence of information and communications technologies

Developing technologies are changing the lives of communities, families and individuals around the world through providing new goods and services, including to “bottom of the pyramid” consumers, creating new industries and markets, and changing demand for labour and capital (Gradl, Sobhani, Bootsman and Gasnier, 2017: 269). The Internet of Things (IoT) and big data analytics have become the dawning technological revolution, and owing to its enormous benefits, they have been adopted in diverse domains for varying purposes. IoT and big data analytics have been utilised in manufacturing, agriculture, banks, oil and gas, healthcare, retail, hospitality and food services (Hussein, Kamarudin, Hussain, Zakaria, Ahmed and Zahri, 2013). Information Communications Technology (ICT) can play a significant role in the conservation and sustainable use of the oceans, notably through improved monitoring and reporting, which leads to increased accountability. Satellite-based monitoring delivers timely and accurate data on a global basis, while local sensors deliver on the spot updates in real-time.

With the oceans providing the platform for much of the world's economic foundation, the vital role that oceans play in climate and economies is an area that warrants future-oriented thinking (OECD, 2016; Degnarain at al, 2017). ICT and data services are a vital component of the digital revolution currently happening within the ocean economy and associated industries. Changes, like Brexit, trade wars, increasing extreme weather and COVID-19 have caused ripple effects throughout most ocean economy industries. As competition grows and markets tighten, profitability becomes a matter of calculations and careful planning. Environmental compliance, port regulations, and decarbonisation are a few factors that impact maritime profitability. In the next decade, going up to 2030, scientific and technological advances are expected to play a crucial role both in addressing many of the ocean-related environmental challenges and in the further development of ocean-based economic activities (OECD, 2016). Technological innovations have also led to considerable advances in desalination processes that turn saline water into fresh water, thus potentially revolutionising water supply globally (Trends, 2017). These innovations range from more effective filtration materials to renewable energy-based desalination methods (Bennett et al, 2019). One of these methods is solar desalination, which is seen as a new source of fresh water and a sustainable means to access it, particularly in the countries that have abundant solar energy and yet face severe water stress (Gradl et al, 2017). Innovations in advanced materials, sub-sea engineering and technology, sensors and imaging, satellite technologies, computerisation and big data analytics, autonomous systems, biotechnology and nanotechnology, every sector of the ocean economy stands to be affected by these technological advances.

As highlighted by the OECD (2016), another significant technological innovation within the ocean economy is with commercial shipping, which is on the verge of rolling autonomous ships and introducing greater use of new fuels. The OECD (2016) report further expands on how oil and gas and seabed mining companies are all looking to robotics for their subsea operations. marine aquaculture is building on advances in biotechnology to improve fish health and welfare and reduce dependence on wild fish catches for feed, renewable ocean energies are making increasing use of advances in new materials and sensors, fisheries, maritime safety, ocean observation and environmental assessment will continue to benefit from the great strides that are being made in satellite technologies (communications, remote sensing, navigation) and cruise tourism is scaling up its on-board digital facilities for passengers and crew to unprecedented levels.

3.3.7 Promoting ethical market economies in reducing inequality

There are different kinds of markets in different regions, but they are markets, nonetheless (Tralac, 2018). As cited by the World Bank (2018), there are vast disparities of wealth in the world currently, and any number of statistics can be found to demonstrate the growing gap between the top 10% and much of the earth's population, in which there are enormous levels of poverty. Increasing concentration of wealth is one of the main factors undermining the rich-poor gap reduction (The Economist, 2014). The World Economic Forum (2017) identified income disparity as the most likely global risk over the next decade, while in 2015, growing unemployment and underemployment were seen as being both likely and serious.

Across the OECD countries, the average income of the richest 10% of the population versus the poorest 10% is almost 10:1 today, compared with 7:1 in the 1980s and 9:1 in the 2000s (OECD, 2008). The ratio between wages and profit is increasingly and dangerously imbalanced, undermining long-term economic prosperity. Although financial leaders are placing inequality and structural reforms at the top of the world policy agenda, effective action has yet to be seen. Consequently, the 1% versus 99% movement remains strong is raising the consciousness of people everywhere and questions the integrity of financial leaders and the fairness of the current economic system, calling for changes toward more sustainable prosperity and a real material commitment to building a world with human dignity (The Millennium Project, 2015). As earnings have become more unequal, so has income from capital, including dividends, interest, rent and capital gains. The distribution of self-employment incomes has also widened. Together, these changes account for a significant part of the growth in inequality of household income. Inequality of market incomes (from earnings, self-employment and capital) increased more rapidly than that for net incomes (including benefits, for example) between the mid-1980s and the mid-2000s (OECD, 2008).

The ocean economy has and continues to be viewed by numerous governments and corporations as a lucrative frontier for investment, either through fisheries, aquaculture, tourism, bioprospecting, seabed mining, oil and gas, renewable energy and shipping (Bennett, Montemayor, Blythe, Silver, Singh, Andrews, Calò and Di Franco, 2019). At a Sustainable Blue Economy Conference in Kenya in 2018, for example, specific concerns relating to small-scale fisheries (SSFs), Indigenous peoples, women and youth featured prominently in an attempt to reduce inequality within the ocean economy (FAO, 2017). Ethical market economies require improved fair trade, increased economic freedom, a "level playing field" guaranteed by an honest judicial system with adherence to the rule of law, and by governments that provide political stability, a chance to participate in local development decisions, reduced corruption, insured property rights, business incentives to comply with social and environmental goals, a healthy investment climate and access to land, capital and information (Tralac, 2018: 2). However, the rhetoric of equity, inclusion and benefit sharing appears to be outpacing policymaking and the implementation of best practices will be key in achieving growth in the ocean economy and promoting social equity and environmental protection.

3.3.8 Reducing threat of new and re-emerging diseases and immune microorganisms

Emerging infections (EIs) can be defined as "infections that have newly-appeared in a population or have existed previously but are rapidly increasing in incidence or geographic range" (Morens, Folkers and Fauci, 2004: 242). The classification of EIs as *newly emerging*, *re-emerging/resurging* or *deliberately emerging* is useful because the underlying causes of emergence and the optimal prevention or control responses frequently differ between the groups. Newly-emerging infections are those that have not previously been recognised in people. Many diverse factors contribute to the emergences of infectious diseases, these include microbial genetic mutation and viral genetic recombination or re-assortment, changes in populations of reservoir hosts or intermediate insect vectors, microbial switching from animal to human hosts, human behavioural changes (notably human movement and urbanisation), and environmental factors (United Nations, 2011). These numerous microbial, host and environmental factors interact to create opportunities for infectious agents to evolve into new ecological niches, reach and adapt to new hosts, and spread more easily between them. Morens et al (2004), United Nations (2011) and The Millennium Development (2015) project conclude that EIs have shaped the course of human history and have caused incalculable misery and death.

According to WHO (1997) the conventional scope of estimating economic impact of disease events in humans has often been limited to basic direct costs (health care) and limited indirect losses (for example, wages not earned and informal health costs such as patient transport). Disease burden may be captured in health metrics (for example, number of deaths or Disability-Adjusted Life Years). While meaningful for the health community, it is increasingly becoming evident that this limited scope of analysis does not provide a comprehensive view of economic consequence of disease events, including contagion avoidance behaviours, to inform decision-making by a wider range of stakeholders and connect to broader economic development agendas (UNCTAD, 2020b). WHO (1997) further argues that direct and indirect economic impacts of disease events are affected by disease preparedness and prevention (practices that mitigate risk), the event itself (for example, business continuity, supply chain disruption, trade and travel bans, public contagion avoidance behaviour), and the event aftermath (for example, long-term employment loss, permanently closed markets or farms, long-term stigmas associated with specific animal products, impacts of childhood lost education or being orphaned).

Health sector impacts of infectious disease outbreaks are often the most straightforward to estimate or at least tally retroactively (WHO, 1997, UNCTAD, 2020b). However, for novel or re-emerging pathogens with unexpected clinical outcomes, predictions can be difficult and cost estimates are frequently limited to short-term medical spending, health burden, or mortality. For example, while typical Zika infections without sequelae are unlikely to result in significant burden, disease manifestation in infants can have extensive impacts (Morens et al, 2004). Not only are direct medical expenses expected to build during pregnancy, but post-natal direct and indirect costs, particularly given the implied long-term extensive care required for these children as they grow, will be significant.

The present international system is now more globally-interdependent than at any other time in history with humans continuing to dramatically affect the global biosphere in deep and complex ways (United Nations, 2011; The Millennium Project, 2015, Chalk, 2017). People can physically move from one part of the world to another at the same time (if not more rapidly) than it used to take to journey between cities or countries. As cited by the WHO (1997) no part of the planet remains inaccessible to human penetration, with current estimates of the number of people crossing international frontiers on board commercial flights at more than 500 million every year and this can directly increase the risk of increasing the spread of diseases over a wide geographic area. One important effect of such actions has been a gradual increase in the earth's average surface temperature, a change that many scientists now believe has the potential to actively contribute to the transnational spread of disease.

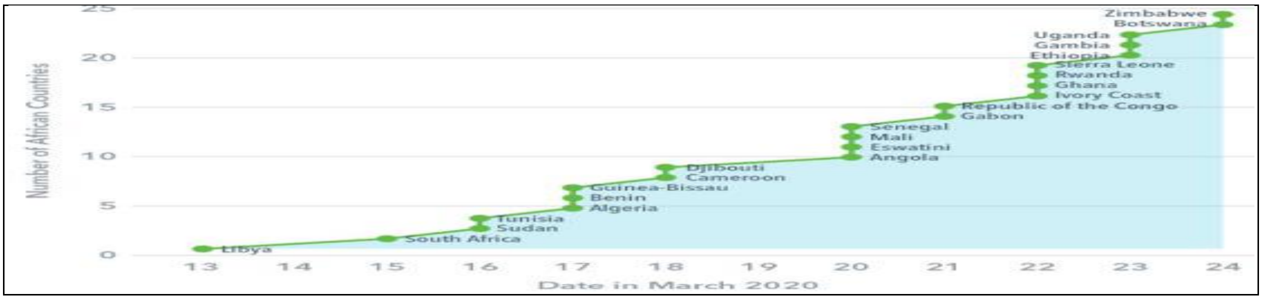
According to two 2001 UN studies by the Intergovernmental Panel on Climate Change (IPCC), the earth's temperature could rise between 1.4 and 5.8 degrees Celsius over the 1990 average surface temperature during the next century. Global warming could expose millions of people for the first time to malaria, sleeping sickness, dengue fever, yellow fever and other insect-borne illnesses. In the United States, for instance, a slight increase in overall temperature would allow the mosquitoes that carry dengue fever to survive as far north as New York City. Also, the insects that carry the plasmodium falciparum parasite, which causes malaria, thrive in the warm climates of the tropics. Increased temperatures in more temperate areas could, conceivably, provide a habitat suitable for the increased distribution of these anopheline vectors (IPCC, 2011). Of particular concern are the studies that show an association between climatic events and outbreaks of diseases that have already occurred in several parts of the world. Instances of malaria in Madagascar, India, Ethiopia and Peru have been attributed to sudden increases in mosquito densities resulting from higher rainfall patterns in arid and semiarid regions (United Nations, 2011).

The outbreak (COVID-19) of the new coronavirus (SARS-CoV-2) in China and the beginning of its subsequent global spread is already impacting global health systems and the global economy. The novel coronavirus, which causes COVID-19 first broke out in the port city of Wuhan, China, in December 2019. The city is a major industrial and transport hub, one of China's ten most populous cities, and the capital of Hubei province. The city has more than 6,000 foreign-invested companies from over 80 countries and the province produces 4.5% of China's GDP. It is believed that the genesis of the virus came from an informal seafood market. The virus has subsequently spread around the world, leading to the World Health Organisation (WHO) declaring it a pandemic on 11 March 2020. Following the declaration by the WHO, many governments across the world embarked on numerous strict measures to lockdown their countries to "flatten" the curve of COVID-19 (UNCTAD, 2020b). China was the first country to implement a shutdown, followed by Italy, the rest of Europe, and from 27 March, South Africa as well. At the core of these lockdowns was the restriction on movement of goods and people by closing entry points like air, sea and land ports, and severely disrupting global value chain and supply channels. The magnitude and speed of the collapse in activity in the ocean economy is unlike anything that has been experienced since the 1918 influenza epidemic (SAIMI, 2020). Owing to the slowdown in demand in the shipping industry, many ports have experienced a reduction in the number of vessels calling because of rescheduling of itineraries, as a result of the decrease in cargo volumes. Some ports are also experiencing a decline in exports, because of the closure of destination ports in Asia and Europe (UNCTAD, 2020a; Notteboom, Pallis, and Rodrigue, 2021). Container ships sit idle around the world, reminiscent of the global financial crisis of 2008. A Chinese coastal port also registered a drop of 10.1% of total container volumes handled compared to the first quarter of 2019 (SAIMI, 2020).

A survey conducted by the international association of ports and harbours (IAPH) on global ports reports that over 40% of the ports experience moderate (minus 5% to 25%) and, in some ports, even significant decreases (in excess of a 25%) drop in the number of vessel calls (SAIMI, 2020). With China being the first country to institute a lockdown, global demand weakened and the slump for goods from China has had a ripple effect on container ships across the globe (Notteboom et al 2021). Seeing major container shipping companies such as Maersk and MSC temporarily suspend their trade route between Asia and Europe owing to the COVID-19 pandemic offers a vivid picture of the impact of the pandemic in the shipping and logistics industry.

From a regional perspective, governments across Africa responded quickly to the potential risk of the pandemic and introduced public health measures to prevent the spread of the virus. Figure 3.3 illustrates the stepped introduction of partial or complete closure of borders, with 43 of the 54 states implementing such measures by early April. These measures formed part of a package of measures to protect public health including lockdowns, bans on public gatherings, increased health screening at ports, including testing of drivers at border crossings, restrictions on ship berthing and crew access to shore, and quarantine enforcement (World Bank, 2020).

Figure 3.3: Progression of African border restrictions and closings in March 2020



Source: World Bank (2020).

The economic impact of the global lockdown has been harshly felt, with the global freight and shipping industry being the biggest casualties. It has been reported that close to 97% of the global trade is done through the shipping industry and with 24 African countries under lock down restrictions in March 2021 as shown in Figure 3.3, most global trade could not happen during that period. Global shipping markets have now declined, with the collapse in demand for goods from China affecting everything from container ships to oil tankers (SAIMI, 2020; Notteboom et al 2021). Demand has dropped across the board, including at ports, the trucking industry, and the shipping industry. The subdued global demand is also evident in the decline in oil prices which has had a negative impact on the offshore and onshore oil and gas industry.

How countries and international organisations respond to the challenges it presents may have profound lasting impacts for global health (Evans, 2020). The decisions taken, both on national and international levels, will help inform how we react to future pandemics and health security challenges (Smith, Goldberg, Rosenthal, Carlson, Chen, Chen &, 2014; Peters, Vetter, Guitart, Lotfinejad & Pittet, 2020). Evans (2020) further cites that global disease outbreaks and pandemics have been increasing exponentially over the last 40 years, and experts have long been warning of the potentially devastating effects of a severe pandemic, though it is important to note that the improvement in diagnostic capabilities undoubtedly plays a role. There are numerous reasons for the exponential growth of global pandemics, but the most frequently cited include the expansion of the human population, destabilisation of ecosystems and globalisation (Evans, 2020). Humans are coming into contact with environments that were previously untouched, as it has been shown in many instances within the ocean economy, meaning that they will also come into contact with the viruses and bacteria that are inherent to those environments (Smith et al 2014; Evans, 2020; Peters et al, 2020). Evans (2020) concludes by saying that many of these will have no impact on human health, but some do.

3.3.9 Improving the capacity to decide nature of work and institutional change

There has never been a time when mankind was not afraid of where its talent for innovation might lead. In the 19th century, Karl Marx worried that “machinery does not just act as a superior competitor to the worker, always on the point of making him superfluous. It is the most powerful weapon for suppressing strikes” (The World Bank, 2019). The World Bank (2019) further cite John Maynard Keynes who warned in 1930 of widespread unemployment arising from technology and yet innovation has transformed living standards. Life expectancy has gone up, basic health care and education are widespread, and most people have seen their incomes rise (World Health Organisation, 2018).

Glenn (2015) cites that the acceleration of change and interdependence, plus the proliferation of choices and the growing number of people and cultures involved in decisions, increases uncertainty, unpredictability, ambiguity and surprise. This increasing complexity is forcing humans to rely more and more on expert advice and computers. Just as the autonomic nervous system runs most biological decision-making, so too are computer systems increasingly making the day-today decisions of civilisation (Glenn, 2015). The acceleration of change reduces the time from the recognition of the need to decide to completion of all the steps to make the right decision. As a result, many of the world’s institutions and decision-making processes are inefficient, slow and ill-informed. Institutional structures are not anticipating and responding quickly enough to the acceleration of change, hence, social unrest is likely to continue until new structures provide better management.

3.3.10 Reducing ethnic conflicts, terrorism and weapons of mass destruction use through shared values and new security strategies

Industrial-age military force is not sufficient to counter asymmetrical warfare. Engagement of the disenfranchised by the more powerful is essential to reducing terrorism and ethnic conflicts. Since chemical, biological, low-level nuclear (*dirty*) bombs, and information warfare weapons of mass destruction and disruption may be available to individuals over the next 25 years, it is important that society learns how to connect education and security systems in a healthy way and to deal with a global environment in which the boundaries between war, civil unrest, terrorism and crime are increasingly blurred (The Millennium Project, 2015).

Governments and industrial complexes often find themselves under multiple daily cyberattacks (espionage or sabotage) from other governments, competitors, hackers, and organised crime. It seems intellectual software arms races will be inevitable (Glenn, 2015). From a regional perspective, the African Union has created a Peace and Security Council to strengthen multilateral collective security. As many AIDS orphans grow up in crime and teenage population grows, the continent could become more violent. Although some conflicts may have been triggered by environmental degradation, they surfaced as ethnic disagreements or as religious and border clashes (The Millennium Project, 2015).

In relation to the ocean economy, maritime piracy is a traditional threat to maritime security, which is still very much alive at sea nowadays, with ancient records indicating that it had been threatening the Minoan maritime commerce in the East Mediterranean as early as 40 centuries ago (Fu, Ng and Lau, 2010). Although maritime piracy can have several meanings with no direct legal implications, according to the 1982 United Nations Convention on the Law of the Sea (UNCLOS), any criminal acts of violence, detention, or depredation committed for private ends by the crew or the passengers of a private ship that is directed on the high seas against another ship, or against people or property on board a ship can be understood as maritime piracy (UNCLOS 1982, Article 101).

3.3.11 Improving the human condition through changing status of women

Empowerment of women has been one of the strongest drivers of social evolution over the past century and is acknowledged as essential for addressing all the global challenges facing humanity (The Millennium Project, 2015; World Bank, 2015). Gender equity has entered the global consciousness and is guaranteed by the constitution of 84% of the world's nations, while "the international women's bill of rights" (CEDAW) has been ratified by all but seven countries. Countries are reforming, and the empowerment of women continues to be viewed as one of the strongest drivers of social evolution over the past century and is acknowledged as essential for addressing the global challenges facing humanity. Women are increasingly engaged in decision-making, promoting their own views and demanding accountability not only in traditional female-dominated industries (namely, services and banking) but also in the ocean economy. Since changes to the family code in the Democratic Republic of Congo in 2016, a woman can register her business, open a bank account, apply for a loan, sign a contract, and register land without her husband's permission (World Bank, 2015). Zambia's Gender Equity and Equality Act of 2015 prohibits gender discrimination in employment. Iraq guarantees workers returning after maternity leave a similar position and the same wage. China has increased its paid paternity leave. Afghanistan forbids sexual harassment in employment and education (World Bank, 2019). The World Bank (2019) further cites that sixty-five countries made gender equality reforms between 2015 and 2017.

As cited in The Millennium Development Project (2015), Dr Nkosazana Dlamini-Zuma of South Africa became the first woman Chairperson of the African Union Commission. In sub-Saharan Africa, female representation is 23.5% in legislatures, while Rwanda has a women-majority parliament. Three sub-Saharan African countries are ranked among the top 20 by the 2014 Global Gender Gap Index, namely, Rwanda (7), Burundi (17), South Africa (18), and 13 out of the 28 countries assessed have closed over 70% of the gender gap (World Bank, 2019). This is mainly due to the increased participation of women in the workforce, although generally, these are in low-skilled and low-paying jobs. ILO (2017) notes that women have a nearly 85% likelihood to be in vulnerable employment versus 70% for male. Adult female labour force participation was expected to slightly increase from almost 72% in 2014 to 72.4% in 2018, yet lower than their male counterparts, which is estimated at 87.7% and almost 89%, respectively (World Bank, 2019). Ac cited with the World Bank report (2019), ActionAid, a global federation working for a world free from poverty and injustice, shows that closing the wage and employment gender gap would mean an 121% income increase for women, valued at some $0.7 trillion. Globally, women represent less than 2% of the total workforce across all ocean economy industries (IMO, 2019). Low levels of education and qualification makes it very difficult for the region and for women specifically to escape the poverty vulnerability cycle (World Bank, 2015).

In addition, the South African maritime sector / ocean economy remains a very male-dominated sector, and compared with other sectors, the integration and participation of women has been slow (Cele, 2003; Transnet, 2019). Because of the male-dominated nature of this sector, in trying to better understand the gender issues at play, numerous studies and efforts have been conducted to better understand the perceptions of both males and female employees in the ocean economy, women's experiences, gender equity practices, as well as training and support programs aimed at eliminating gender discriminatory practices in all identified six sectors within the ocean economy (Transnet, 2019; IMO 2019). Cele (2003) and the IMO (2019) identified the relevance of sea experience to many shore-based jobs means the resource of women with appropriate skills is limited and will continue to act as a long-term constraint on the representation of women in the maritime sector as a whole and that still remains the case.

3.3.12 Preventing transnational organised crime networks from becoming more powerful and sophisticated global enterprises

According to the Organisation for Security and Cooperation in Europe (OSCE) (2020), globalisation and technological advances have increased the scope and extent of the threat that organised crime constitutes. Moreover, organised crime often runs parallel with terrorism, regarding both actors and methods. Smuggling of migrants and trafficking in human beings, illicit traffic in narcotic drugs, in small arms and light weapons as well as in sensitive materials and technologies, are other criminal activities that may pose a threat to stability and security globally (OSCE, 2020). The Millennium Project (2015) further reported that transnational organised crime is estimated to get twice as much income as all military budgets combined per year.

Distinctions among organised crime, insurgency and terrorism have begun to blur, giving new markets for organised crime and increasing threats to democracies, development, and security (The Millennium Project, 2015; OSCE, 2020; Potgieter, 2018). For the ocean economy, the threat of criminal activity in the fisheries sector has concerned the international community for a number of years and countries are also increasing their efforts in combating fisheries crime (Witbooi, Ali, Santosa, Hurley, Husein, Maharaj, Okafor-Yarwood, Quiroz and Salas, 2020).

3.3.13 Meeting growing energy demands safely and efficiently

Energy is a fundamental input to economic activity. Modern energy services light up homes and schools, fuel economic activity to produce and consume, provide comfort and mobility, pump water and contribute to health and well-being (OECD, 2012). According to The Millennium Project (2015), in just 38 years, the world should create enough electrical production capacity for an additional 3.3 billion people. There are 1.3 billion people (20% of the world) without electricity today, and an addition 2 billion people will be added to the world's population between now and 2050 (OECD, 2012; The Millennium Project, 2015). Compounding this is the requirement to decommission aging nuclear power plants and to replace or retrofit fossil fuel plants. About 3 billion people still rely on traditional biomass for cooking and heating. If the long-term trends toward a wealthier and more sophisticated world continue, the energy demands by 2050 could be more than expected. However, the convergences of technologies are accelerating to make energy efficiencies far greater by 2050 than most would believe possible today (The Millennium Project, 2015). In summary, the world is in a race between making a fundamental transition fast enough to safer energy and the growing needs of an expanding and wealthier population.

About half of the new energy generation capacity comes from renewable sources today. IPCC's best-case scenario estimates that renewable sources could meet 77% of global energy demand by 2050, while the World Wildlife Fund claims 100% is possible (IPCC, 2011). The costs of geothermal, wind, solar and biomass are falling, setting a price for carbon emissions could increase investments. If the full financial and environmental costs for fossil fuels were considered, namely, mining, transportation, protecting supply lines, water for cooling, clean-ups and waste storage, then renewables will be seen as far more cost-effective than they are today (WWF Energy Report, 2011).

The ocean may also be a new economic frontier, driven by a growing population in search of new sources of growth, and rapid technological advances making new resources accessible (Economist Intelligence Unit 2015; OECD 2016). For example, global offshore wind capacity has developed from practically nothing twenty years ago to a capacity of more than 7 gigawatts (GW) today, and projections suggest further growth of an order of magnitude by 2050 (OECD 2016). The ocean can produce two types of energy, namely, thermal energy from the sun's heat, and mechanical energy from the tides and waves (Ocean Energy Tech, 2019). With oceans covering more than 70% of Earth's surface, this potentially makes them the world's largest solar collectors. The sun's heat warms the surface water a lot more than the deep ocean water, and this temperature difference creates thermal energy. Just a small portion of the heat trapped in the ocean could power the world (Ocean Energy Tech, 2019).

3.3.14 Accelerating scientific and technological breakthroughs and improved human conditions

The continued acceleration of Science and Technology (S&T) is fundamentally changing what is possible, and access to the S&T knowledge that is changing the prospects for the future is becoming universal (The Millennium Project, 2015). Free online university courses proliferate; open-source hardware and software are sharing the means of production. The ability to learn this knowledge is also improving with Web-based asynchronous highly-motivational educational systems, adaptive learning models such as cellular automata, genetic algorithms, neural networks, and emerging capabilities of collective intelligence systems (World Bank 2018).

Technology continues to play a profound role in shaping the global risks landscape for individuals, governments and businesses (World Economic Forum, 2019). In a global risk study conducted by the World Economic Forum in 2018, a large majority of participants expected increased risks in 2019 of cyber-attacks leading to theft of money and data (82%) and disruption of operations (80%). The survey reflects how new instabilities are being caused by the deepening integration of digital technologies into every aspect of life. Around two-thirds of participants expect the risks associated with fake news and identity theft to increase in 2019, while three-fifths said the same about loss of privacy to companies and governments (World Economic Forum, 2019).

Improvements in science and technology in areas linked to the ocean economy can be cited in the flow of information between transport operators at the port and in the hinterland, which is much better than what it was two decades ago (OECD, 2012). With the Internet of Things (IoT), even the most commonplace objects are connected via the internet. Equipped with sensors, they send information on their location, temperature, load or anything else that could be relevant. In automated ports, the tendency to “go wireless” is increasingly obvious owing to its flexible-deployment advantage (OECD, 2012; OECD, 2016; UNCTAD, 2018). But there are still some challenging issues during the implementation of wireless transmission. According to UNCTAD (2018), the most challenging one is that these wireless devices are prone to be affected by big metal parts and high-power electrical appliances. To tackle this issue, anti-jamming antenna technologies are developed, in which antenna gains can be adjustable self-adaptively according to the interference situation (UNCTAD, 2018). Another area that the ocean economy industries need to safeguard against is cyber-attacks, which may lead to theft of money and data and disruption of operations (OECD, 2016).

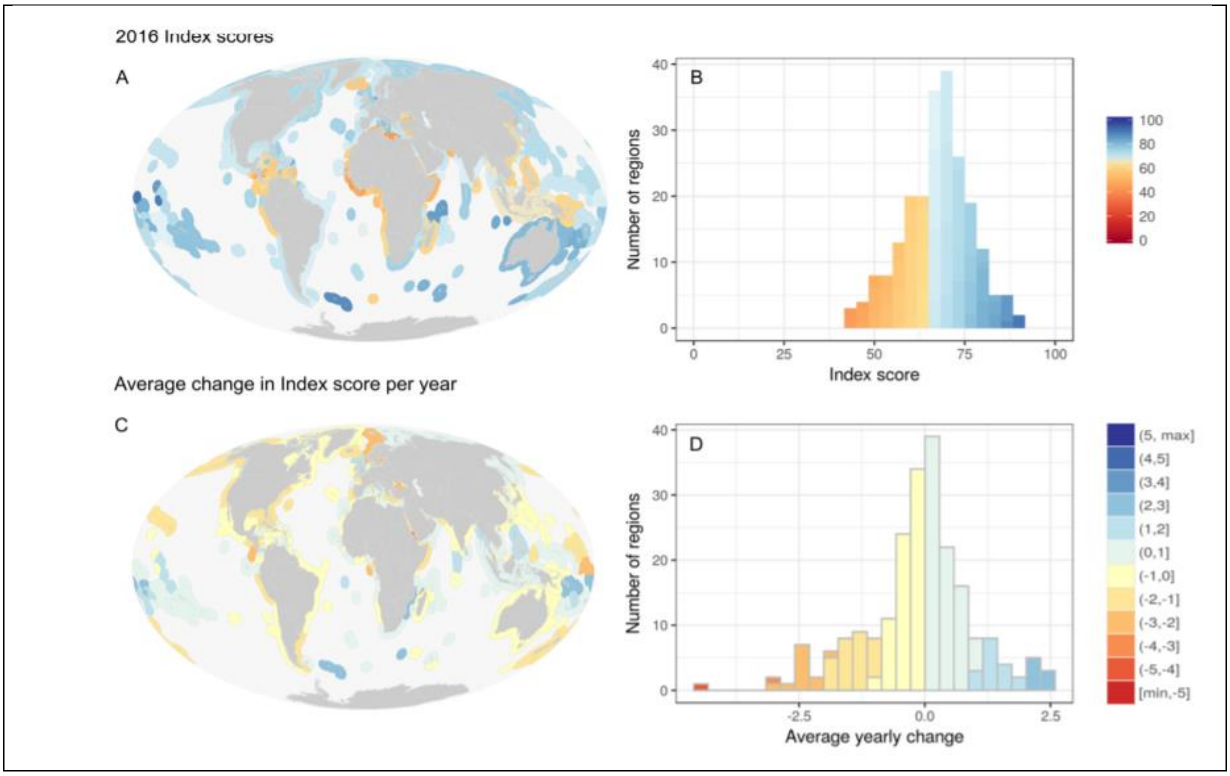
3.3.15 Incorporating ethical considerations into global decisions

Corruption is not the invention of globalisation. But neo-liberal economy has given new faces to corruption (Kochuthara, 2017). A study published in November 2010 by Global Financial Integrity (GFI), an international advocacy group, says that corruption in India has increased considerably after liberalisation (Integrity, 2019). According to its report, between 2002 and 2006, the loss to the government owing to corruption was 16 billion dollars per year (Integrity, 2019). An economic model, in which profit is the only value, becomes an economy without ethics. Profit, even at the denial of justice, becomes the only ethics. Such an economic system is disastrous and will not lead to real development (The Millennium Project, 2015).

Globalisation involves competitive systems, such as global economy and financial markets, politics and international relations and courts. According to Pogge (2013), “the fundamental flaw in the modern global economy is that the richest agents have both the ability and the incentives to invest extensive resources into regulatory capture in order to gain an ever-increasing share of the social product for themselves". A complex set of supranational laws and regulations is an essential part of globalisation (Pogge, 2013). These regulations are often created by intergovernmental negotiations, practically by governments of the richest countries, large multinational corporations and banks, very rich individuals and the elites of the most powerful developing countries (Pogge, 2013; Kochuthara, 2017). It is a process which is undemocratic, unclear, excluding the general public and a majority of the weaker governments. Hence, Pogge (2013: 85) identifies that, "It should not be surprising that the past seventeen years of globalisation have led to income polarisation as the rich minority capture ever more influence over supranational negotiations, further marginalising the poorer majority of humanity". This income polarisation happens not only internationally, but also intra-nationally (Pogge, 2013).

Although listed in sequence, Global Challenge 1 on sustainable development and climate change is no more or less important than Global Challenge 15 on global ethics. There is greater consensus about the global situation as expressed in these challenges and the actions to address them than is evident in the news media. In concluding the 15 Global challenges, a brief explanation of the Ocean Health Index (OHI) and some of the indices that form the basis of the Index score will be highlighted as they respond or attempt to offer alternative to the identified challenges (Halpern, Longo, Lowndes, Best, Frazier, Katona, Kleisner, Rosenberg, Scarborough and Selig, 2015). The Ocean Health Index (OHI), updated annually since 2012, is one of the indicators identified for use in tracking SDG 14. It is also being used widely at regional and local scales to assess ocean health and inform regional policy and decision making. Based on the premise that a healthy ocean sustainably delivers a range of benefits to people now and in the future, OHI measures how well countries are performing in achieving maximum sustainable flows of 13 key ocean benefits, called goals. Map and distribution of OHI Index scores and average yearly change in scores are presented in Figure 3.4. Figure 3.4 shows four maps, (A) being a map of 2016 per-region scores with lowest scores generally in tropical areas and highest scores generally in South Pacific and Southern Oceans. The second map (B) shows distribution of per-region scores, which is normally distributed around the global OHI score of 71. Map (C) shows the per-region average yearly change in Index scores from 2012 to 2016 (based on linear regression analysis of Index scores), and map (D) shows the distribution of average change among regions. Success is expressed on a scale of 0 to 100 toward the achievement of a designated target, or reference point. Global assessments score individual goals in each coastal region (country or territory), and goal scores are averaged into an index score for each region, which are then used to calculate global index and goal scores.

Figure 3.4: Map and distribution of OHI index scores and average yearly change in scores



Source: Halpern et al (2015).

As shown in the maps and graphs in Figure 3.4, the index score for South Africa is in the region of 80/100 and the average yearly change in index scores from 2012 to 2016 for South Africa is sitting at 0,1, signifying a healthy ocean sustainably. Collective responsibility for global ethics in decision-making is embryonic but growing. Corporate social responsibility programs, ethical marketing, and social investing are increasing. New technologies make it easier for more people to do better at a faster pace than ever before. Single individuals initiate groups on the internet, organising actions worldwide around specific ethical issues. News media, blogs, mobile phone cameras, ethics commissions and NGOs are increasingly exposing unethical decisions and corrupt practices. Advance software experts in the self-organising international group called Anonymous have become a new force increasing world attention to help the Arab Spring, Wikileaks, the Occupy movement, and opposition to police brutality. Global ethics are emerging around the world through the evolution of ISO standards and international treaties that are defining the norms of civilisation. They may also be evolving from protests around the world that show a growing unwillingness to tolerate unethical decision making by power elites.

Table 3.1 summarises the 15 global challenges and their relation to the ocean economy. These 15 global challenges, as highlighted under The Millennium Project (2015) are independent but may not be approached in an integrated manner to ensure that they support the 15 SDGs and may positively impact development within the ocean economy. Table 3.1 provides a brief description of the 15 global challenges in relation to the ocean economy.

Table 3.1: Summary of the 15 global challenges and the ocean economy

Global challenge	Description
1. Addressing global climate change and sustainable development	The oceans regulate the global climate. Protecting and restoring oceans in changing climates requires a range of strategies.
2. Providing sufficient clean water without conflict	With portable water central to development and climate change as a result, if climate change results in significant sea level rise, 20% of the world's coastal freshwater may become saline (The Millennium Project, 2015), which will affect the availability of clean water without nations having to go into conflict.
3. Balancing population growth and resources	The demand for food and for basic shelter, in relation to the ocean and its resources, tends to closely parallel human population growth (OECD, 2012; World Bank, 2018).
4. Ensuring genuine democracy from authoritarian regimes	What genuine democracy from authoritarian regimes implies for the ocean economy is the fact that businesses and citizens in coastal areas or part of the ocean economy are able to benefit from well-managed resources. Democracy can influence the future of the industry and ensure that conflicts or challenges around resource and environmental sustainability are minimised as freedom and democracy continue to make overall progress worldwide.

Global challenge	Description
5. Ensuring policymaking and sensitivity towards global long-term perspectives	It is in the vital interests of governments of coastal states but also of many land-locked economies to understand the implications of an expanding ocean economy for the design and implementation of policy, especially policies that shape the competitiveness of their national maritime industries and which affect the health of oceans within their national jurisdiction and beyond.
6. Providing the global convergence of information and communications technologies	Significant technological innovation within the ocean economy can play a significant role in the conservation and sustainable use of the oceans, notably through improved monitoring and reporting, which leads to increased accountability.
7. Promoting ethical market economies in reducing inequality	The rhetoric of equity, inclusion and benefit-sharing appears to be outpacing policymaking and the implementation of best practices will be key in achieving growth in the ocean economy and promoting social equity and environmental protection
8. Reducing threat of new and re-emerging diseases and immune microorganisms	Epidemics impact people’s health and livelihoods far beyond the direct effects of the outbreak in the sectors of the countries where the disease occurs, and this may pose huge challenges for the ocean economy, which is a global industry.
9. Improving the capacity to decide as the nature of work and institutions change	Institutional structures are not anticipating and responding quickly enough to the acceleration of change within the ocean economy; hence, social unrest is likely to continue until new structures provide better management.
10. Reducing ethnic conflicts, terrorism, and the use of weapons of mass destruction through shared values and new security strategies	Maritime piracy is a traditional threat to maritime security, which is still active at sea nowadays, with ancient records indicating that it had been threatening the Minoan maritime commerce in the East Mediterranean as early as 40 centuries ago (Fu et al, 2010).
11. Improving the human condition through the changing status of women	Low levels of education and qualification make it very difficult for the region and for women in developing coastal nations to escape the poverty vulnerability cycle.
12. Preventing transnational organised crime networks from becoming more powerful and sophisticated global enterprises	Distinctions among organised crime, insurgency and terrorism have begun to blur, giving new markets for organised crime and increasing threats to democracies, development, and security especially on the high seas.

Global challenge	Description
13. Meeting growing energy demands safely and efficiently	The ocean may also be a new economic frontier, driven by a growing population in search of new sources of growth, and rapid technological advances making new resources accessible (Economist Intelligence Unit, 2015; OECD 2016; World Ocean Summit, 2021).
14. Accelerating scientific and technological breakthroughs and improved human conditions	Improvements in science and technology in areas linked to the ocean economy can be cited in the flow of information between transport operators at the port and in the hinterland, which is much better than what it was two decades ago (OECD, 2012).
15. Incorporating ethical considerations into global decisions	Based on the premise that a healthy ocean sustainably delivers a range of benefits to people now and in the future, the Ocean Health Index (OHI) measures how well countries are performing in achieving maximum sustainable flows of 13 key ocean benefits ranging from fisheries, coastal tourism to coastal protection.

Source: Researcher's own construction.

3.4 SUSTAINABLE DEVELOPMENT

The ocean hosts the world's largest connected ecosystem that provides humans with essential life supporting functions and amenities. The oceans do not only regulate the climate but are in addition expected to provide an increasing amount of energy, food, materials as well as recreational and cultural services to societies worldwide (OECD, 2012; Visbeck et al, 2017; Halpern et al 2015). Accordingly, environmental sustainability for the ocean is of universal concern, which warranted for the formulation of sustainable development targets supported by indices and ocean policies and the monitoring of their success. The development of and commitment to a focused Sustainable Development Goal (SDG) for the ocean and coasts could trigger greater international cooperation towards achieving good environmental status of the ocean and coasts, securing blue wealth, providing equitable access to ocean resources and, at the same time, supporting the development of resilient coastal communities (Sturesson, Weitz & Persson, 2018; Visbeck et al, 2017).

3.4.1 Sustainable Development Goals (SDGs)

In September 2015. the world's governments signed an historic agreement to eradicate poverty, improve the living standards and well-being of all people, promote peace and more inclusive societies and reverse the trend of environmental degradation. The 2030 Agenda for Sustainable Development commits to promoting development in a balanced way, namely, economically, socially and environmentally, in all countries of the world, leaving no one behind and paying special attention to those people who are poorest or most excluded (United Nations, 2015). It contains 17 Sustainable Development Goals (SDGs) with associated targets to assess progress. The 2030 Agenda builds on earlier commitments, more recently, the aspirations set out in the Millennium Development Goals (MDGs) and Millennium Declaration. In much of the period leading up to and through the MDGs' target date and, in many parts of the world, progress in several areas that are also reflected in the SDGs has been strong (World Health Organisation, 2018). This is especially the case for income poverty, access to education and health services and improved sources of clean water. In other areas, progress has been steady but less marked, including on gender equality, nutrition and access to sanitation facilities (Dugarova & Gülasan, 2017).

The 2030 Agenda aims to tackle the complex challenges facing the planet today, ending poverty, hunger and malnutrition, responding to climate change while achieving inclusive growth and sustainably managing natural resources (FAO, 2017). In 2019, the United Nation Foundation (2019) cited that despite the 2030 Agenda reaching four years, climate change is identified as the main roadblock to achieving the SDGs and has disproportionate effects on the poor. Without concerted action, it could drive 100 million more people into poverty by 2030 (United Nations Foundation, 2019).

3.4.2 Linkages between SDG 14 and other SDGs

Of the 17 SDGs, SDG 14 aims to "conserve and sustainably use the oceans, seas and marine resources for sustainable development" (United Nations, 2016: 26). Progress on SDG 14 and achieving sustainable use and development of oceans and marine resources is closely-linked to the underlying challenge of Agenda 2030, that is, balancing the social, economic and environmental dimensions of sustainable development. More specifically, SDG 14 is concerned with how to balance competing uses of water resources in an equitable manner while maintaining water quality and ensuring healthy and diverse ecosystems (Lymer and Clausen, 2018). A stand-alone goal in the form of SDG 14, which aims to conserve and sustainably use the oceans, seas and marine resources for sustainable development, clearly illustrates their crucial role for human well-being and the health of the planet (FAO, 2017). Further, SDG 14 goes far beyond conservation to focus on the people and coastal communities, particularly those in developing countries, who rely on these marine resources. Oceans, along with coastal and marine resources, play an essential role in human well-being as well as social and economic development worldwide (FA0, 2018). The ocean is particularly crucial for coastal communities, who represented 37% of the global population in 2010 as it provides livelihood and tourism benefits as well as subsistence and income (United Nations, 2016; FAO, 2017).

In its aims to conserve and sustainably use the oceans, seas and marine resources for sustainable development, SDG 14 includes the following targets (United Nations, 2018[4]):

- *Target 14.1*: By 2025, prevent and significantly reduce all kinds of marine pollution, in particular from land-based activities, including marine debris and nutrient pollution.

- *Target 14.2:* By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, by strengthening their resilience and acting for their restoration to achieve healthy and productive oceans.

- *Target 14.3:* By 2020, minimising and addressing the impact of ocean acidification, by enhancing scientific cooperation at all levels.

- *Target 14.4:* By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics.

- *Target 14.5:* By 2020, conserve at least 10% of coastal and marine areas, consistent with national and international law and based on the best available scientific information.

- *Target 14.7:* By 2030, increase the economic benefits to small island developing states and least developed countries from the sustainable use of marine resources, through sustainable management of fisheries, aquaculture and tourism.

- *Target 14.8:* Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular, small island developing states and least developed countries.

In a study conducted by Sturesson et al (2018) on SDG 14 life below water, the following seven cross-cutting issues and preliminary findings on research needs were identified:

- *Balance competing social, economic and environmental demands for ocean resources*. The formulation of the SDG 14 and its targets aims to balance social, economic and environmental demands for ocean and marine resources. Although all three dimensions of sustainable development in the long-term would mutually benefit from a balanced approach, there is risk for trade-offs to occur in the short-term, for example, between the environmental protection of marine resources and the economic use of the same resources.

- *Balance of timely policy measures and more research-informed policies.* By addressing the significant knowledge gaps on marine and ocean issues, the research community could contribute to the formulation of more effective, efficient and sustainable policies. However, climate research often requires long-term observations, which creates a mismatch with the shorter time perspective of national policymaking but also of Agenda 2030. The remaining ten years until 2030 is challenging for developing new research projects, securing robust results, communicating these to policy and securing political agreement on policy measures.

- *Local, regional and global perspective*. Despite differences in ecosystem characteristics and socio-economic context, many of the world's oceans and seas are facing similar challenges related to climate change.

- *Need for improved models.* Uncertainty in modelling and predictions particularly affect ocean monitoring and planning research, partly because there is limited ability to conduct observations. Improved ocean models would contribute to better overall climate change predictions.

- *Need for forward-looking research*. Research in support of Agenda 2030 needs to be forward-looking and identify issues, which are not included in current goals and targets but which in the medium- and long-term risk becoming important challenges for marine life. An important role for science is thus horizon scanning and identifying the next generation of sustainability challenges, not necessarily already identified in the 2030 Sustainable Development Agenda.

- *Prospects and challenges of multi-disciplinary research*. Multi-disciplinary research has the potential to bridge existing knowledge gaps by bringing different disciplinary knowledge together, but is often constrained by structural challenges, including research funding structures not favourable to building more sustainable multi-stakeholder networks.

- *Science to fill knowledge gaps; but solutions rely on political will.* Additional research or studies could contribute to providing a better understanding of climate change impacts as opposed to solely relying on political influences or what the media portrays as key climate change challenges and impacts of the ocean economy or SGD 14 which focuses on life below the water.

The identified cross-cutting areas, especially those around modelling and predictions, multi-disciplinary research and science to fill knowledge gaps, will be central in promoting an inclusive and a sustainable future for the ocean economy. As highlighted by Lymer and Clausen (2018) and Sturesson et al (2018) an important role for science is horizon scanning and identifying the next generation of sustainability challenges have not necessarily been identified in the SDG Agenda 2030. This was the study's key aim was, namely, investigating a long-term scenario for South Africa's ocean economy towards 2060.

3.4.3 Integration of economic, social and environmental dimensions of sustainable development

Sustainable development requires balanced integration of economic, social and environmental dimensions. Integration of these three dimensions is an urgent shift in policy approach because of the widening income and other gaps in society and the breach of planetary boundaries, which places humanity increasingly at risk (United Nations, 2015; Sturesson et al 2018). The SDGs are characterised by three signature elements, namely, balancing the economic, environmental and social dimensions of sustainable development leaving no one behind and ensuring the basic requirements for the well-being of future generations. The 2019 SDG report identified that all these elements are at risk of not being realised as per the individual assessments received from various countries. Recent assessments show that, under current trends, the world's social and natural biophysical systems cannot support the aspirations for universal human development that is embedded in the Goals (United Nations, 2019).

3.5 OCEAN ECONOMY GLOBALLY

The ocean economy is a crucial factor in global economic growth and development, offering great opportunities. Further, the ocean is a source of food and provides livelihoods for a significant portion of the global population with food as well as means of transport for approximately 80% of global trade (UNCTAD, 2012). The ocean economy offers a number of opportunities for sustainable and equitable blue growth in both traditional and emerging sectors (Department of Environmental Affairs, 2014). This increased number of activities and interest in the ocean space creates large uncertainties, which gives the consideration of the future new urgency and importance for policymakers, scientists and citizens alike. The ocean economy is influenced by a combination of environmental, social, economic and policy issues and drivers, which have been evident in discussions about the future of ocean resources across regions (UNCTAD, 2012; OECD, 2016).

The last few years have seen a spectacular increase in attention devoted to the need to protect the world's ocean and seas (World Bank and United Nations Department of Economic and Social Affairs 2017; Walker, 2018). At the same time, interest has been growing in the huge potential offered by the future development of ocean-based industries. Economic activity in the ocean is characterised by a complex variety of risks that need to be addressed. Foremost, among them, are those related to ocean health from over-exploitation of marine resources, pollution, rising sea temperatures and levels, ocean acidification and loss of biodiversity (OECD, 2016).

The OECD (2016), the World Bank and United Nations Department of Economic and Social Affairs (2017) state that different pathways toward the ocean economy depend on national and local priorities as well as goals that are linked to sustainable development goals. For countries to grow their ocean economy, the OECD (2016) identified common steps that will be required by all countries aiming to adopt this approach to managing their oceans, including:

- Valuing the contribution of natural oceanic capital to welfare, to make the right policy decisions, with regard to trade-offs amongst different sectors of the ocean economy.
- Investing in and using the best available science, data and technology is critical to underpinning governance reforms and shaping management decisions to enact long-term change.
- Weighing the relative importance of each sector of the blue economy and decide, based on its own priorities and circumstances, which ones to prioritise. This prioritisation can be carried out through appropriate investments and should be based on accurate valuation of a country's national capital, natural, human resources and productive capacity.
- Anticipating and adapting to the impacts of climate change is an essential component of a sustainable economy approach. National investments to this end must be complemented by regional and global cooperation around shared priorities and objectives.

- Ensuring ocean health will require new investment, and targeted financial instruments, including blue bonds, insurance and debt-for-adaptation swaps can help leverage this investment to ensure that it maximises a triple bottom line in terms of financial, social and environmental returns that the ocean economy can provide.

- Implementing the United Nations Convention on the Law of the Sea is a necessary aspect of promoting the ocean economy concept globally. This convention sets out the legal framework within which all activities in the oceans and seas must be carried out, including the conservation and sustainable use of the oceans and their resources. The effective implementation of the convention, its implementing agreements and other relevant instruments is essential to build robust legal and institutional frameworks, including for investment and business. These frameworks will help achieve SDG and National Development Corporation (NDC) commitments, especially those around economic diversification, job creation, food security, poverty reduction and economic development.

- Realising the full potential of the ocean economy also requires the effective inclusion and active participation of all societal groups, especially women, young people, local communities, indigenous peoples, and marginalised or underrepresented groups. In this context, traditional knowledge and practices can also provide culturally-appropriate approaches for supporting improved governance.

- Developing Coastal and Marine Spatial Plans (CMSP) is an important step to guide decision-making for the ocean economy, and for resolving conflicts over ocean space. CMSP brings a spatial dimension to the regulation of marine activities by helping to establish geographical patterns of sea uses within a given area.

3.5.1 Ocean economy industries and world economic growth

Putting a value on ocean-based industries raises public awareness of their importance, offering them higher visibility. It also raises awareness among policymakers, rendering the industries more amenable to policy action. In addition, it enables progress in their development to be tracked over time and their contribution to the overall economy to be tracked in monetary and employment terms. Finally, it lends weight to the perception of ocean-based industries as an increasingly interconnected set of activities whose defining common denominator is the ocean, its use and its resources (OECD, 2016). Moreover, as ocean-based activities, particularly, the emerging ocean industries, continue to grow, competition around the globe will intensify, making it essential for governments and businesses to be able to compare and position the national ocean economy at international level.

The Economic Intelligence Unit (2015) describes the components of the ocean economy as:

- Harvesting of animate and inanimate resources
- Generating new resources such as energy and fresh water
- Providing trade and commerce in and around the ocean
- Providing health and protection management

According to Visbeck et al (2017), the concept of ocean economy is, therefore, subject to multiple interpretations because of the coverage of activities, geographical locations and sectors. From the available literature, an indicative list of sectors and the activities falling within those sectors is illustrated in Table 3.2. While some studies classify different sectors of ocean economy into traditional and emerging sectors, there is hardly any common position on this view.

Table 3.2: Components of the global ocean economy

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

Source: Visbeck et al (2017).

The main economic drivers affecting the components of the ocean economy are diverse and many for all the various sectors and activities as listed in Table 3.2. Patterson and Hardy (2008) and the Economic Intelligence Unit (2015) note that the main economic drivers are food insecurity, new minerals and energy sources, research and development in marine bio-technology, coastal urbanisation, sea-borne trade and commerce, innovation which makes harvesting resources from the ocean feasible and economically-viable as well as ocean protection and conservation activities. Section 3.5.2 the explores the economic activities shaping the ocean economy to highlight current drivers that are key for growth and sustainability in the ocean economy.

3.5.2 Economic activities shaping the ocean economy

Given the wide and growing range of economic activity dependent upon and shaped by the ocean, economists in recent years have begun to measure this activity collectively, as a unique segment of the global economy, which they designate as the ocean economy. The term has not been consistently defined, with 14 different countries using 14 different definitions at one point (Park & Kildow 2014). To promote greater coherence, the OECD suggested in 2016 that the ocean economy be defined as the sum of the economic activities of ocean-based industries and the assets, goods and services of marine ecosystems. This definition includes direct and indirect supporting activities necessary for the functioning of ocean-based industries, even if they are located in landlocked countries (Patterson and Hardy, 2008; OECD, 2016).

Identifying the portions of a national economy tied to the ocean is not always straightforward, as it is often difficult to define what is ocean and what is not? For example, coastal electric power generation, marine-related pharmaceuticals, and salt (the removal of which from water has value for food, potable water, or both) are included by some countries but not by others (Patil, Virdin, Colgan, Hussain, Failler and Vegh (2018). The World Bank and United Nations Department of Economic and Social Affairs (2017) advocates that additional growth of the ocean economy is possible in several areas, especially, fisheries, aquaculture, coastal tourism, marine biotechnology and ocean energy. While some of these sectors will require little encouragement and additional governance, others need more and better planning to achieve their full potential and return more sustainable outcomes (OECD, 2016; World Bank and United Nations Department of Economic and Social Affairs, 2017).

The ocean economy includes both established and emerging industries and, in shaping and building a sustainable ocean economy, a good balance needs to be maintained between the emerging and established industries. Table 3.3 shows the industries and the stage at which these industries are in terms of either being underdeveloped, developed or overdeveloped.

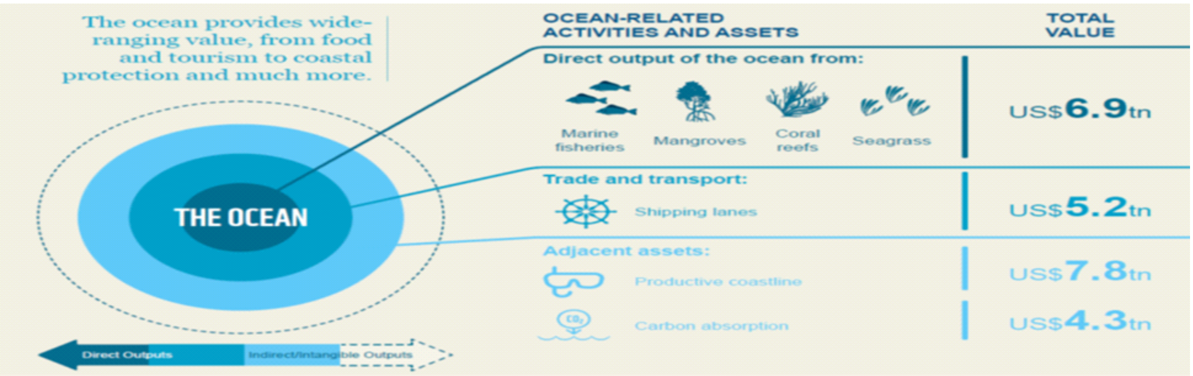
Table 3.3: Ocean economy industries and stages of development

Established		**Emerging**	
1. Capture fisheries	*Overdeveloped*	1. Marine aquaculture	*Developed*
2. Seafood processing	*Developed*	2. Deep- and ultra-deep-water oil and gas	*Underdeveloped*
3. Shipping	*Developed*	3. Offshore wind energy	*Underdeveloped*
4. Ports	*Developed*	4. Ocean renewable energy	*Underdeveloped*
5. Shipbuilding and repair	*Developed*	5. Marine and seabed mining	*Developed*
6. Offshore oil and gas (shallow water)	*Underdeveloped*	6. Maritime safety and surveillance	*Underdeveloped*
7. Marine manufacturing and construction	*Underdeveloped*	7. Marine biotechnology	*Underdeveloped*
8. Maritime and coastal tourism	*Underdeveloped*	8. High-tech marine products and services	*Underdeveloped*
9. Marine business services	*Underdeveloped*	Others	
10. Marine R&D and education	*Developed*		
11. Dredging	*Underdeveloped*		

Source: OECD (2016).

From the 11 established industries presented in Table 3.4, it can be noted that one is overdeveloped, five are developed and five are underdeveloped. Eight emerging industries have been identified and six of them are still new and underdeveloped (OECD, 2016). The ocean continues to be viewed as an important part of the solution to global poverty and hunger (WWF, 2015b). This will only occur, however, if coastal nations work to protect the ocean's capacity to provide ecosystem goods and services. Beyond fisheries and the provision of food, these include tourism, coastal protection and other benefits. Using seven asset categories, the total asset base for the ocean is estimated to be at least US$24 trillion (WWF, 2015a). Figure 3.5 gives a breakdown for the asset categories that cumulatively add up to the US$24 trillion ocean economy asset base**.**

Figure 3.5: Breakdown of the ocean economy asset base



Source: WWF (2015a).

From the asset breakdown provided in Figure 3.5 for the ocean economy and its related activities, it is important to note that marine natural resources such as fishing, mangroves, coral reefs and seagrass, which are regarded as direct output from the ocean, are the second largest asset base sitting at U$6.9 trillion. The sustainability of these resources are key as they drive and support the largest adjacent asset of a productive coastline sitting at an asset base of U$7.8 trillion.

3.5.3 Types of capital underpinning the ocean economy

However, one defines the ocean economy and measures its output, decision-makers should understand the foundations upon which it rests. Following the framework used in Patil et al (2018) for describing the asset base upon which national economic output rests, four classes of assets (capital) are characterised as underpinning output from the ocean economy, namely:

- Natural capital, defined as the stocks of natural assets and resources, such as soil, water, and biodiversity and further sub-divided into (i) stocks of natural resources that are considered “non-renewable,” such as offshore deposits of fossil fuels, minerals, and aggregates, and (ii) spatially-defined stocks of “ecosystem assets”, which are cycled and renewed as part of wider ecosystem functions and which yield a flow of valuable “ecosystem services”.
- Produced capital and urban land, defined as machinery, buildings, equipment, and urban land (residential and non-residential), measured at market prices.
- Human and social capital, defined as the value of skills, experience and effort by the working population, disaggregated by gender and employment status (employed, self-employed) and measured as the discounted value of earnings over a person’s lifetime.
- Net foreign assets, defined as the sum of a country’s external assets and liabilities, for example, foreign direct investment and reserve assets.

The first type of capital underpinning an ocean economy bears further description. The ocean’s natural capital includes not only the physical marine environment itself and the stocks of non-renewable natural resources it contains, but also spatially-defined stocks of ecosystems. The latter are described as ecosystem assets and include stocks typically defined as “renewable resources” (Brown et al, 2016, Bennett et al, 2019). Spatially-defined stocks of ecosystems include processes of multi-species activity taking place in the physical marine environment (Brown et al, 2016). These ecosystem processes ultimately generate what are called ecosystem services, a flow of benefits described as the “interest” that society receives on the ecosystem assets included in the ocean’s natural capital. The flow of ecosystem services is valued by economists as the discounted stream of benefits (Visbeck et al 2017). From this perspective, the ocean’s “natural capital assets” include the stocks of non-renewable natural resources and the stocks of ecosystem assets and their ecosystem services (OECD, 2016).

Research on the flow of ecosystem services provided by ecosystem assets has grown exponentially since the Millennium Ecosystem Assessment (MEA 2005) defined the field. The MEA's (2005) framework in conjunction with the ocean economy analysis and scenarios for 2030 (OECD, 2030) have been used to characterise ecosystem services as follows:

- *Provisioning services* that provide raw materials, food, and energy (for example, seabed deposits, fish stocks, genetic resources, biofuels and abiotic outputs such as minerals)
- *Supporting services* that support and enable the maintenance and delivery of other services (for example, photosynthesis, nutrient cycling, soil, sediment, and sand formation)
- *Regulating services* derived from the natural regulation of ecosystem processes and natural cycles (for example, water regulation, natural hazard regulation, shoreline stabilization, and carbon sequestration)
- *Cultural services* that represent the benefits received from experiences in natural environments (for example, tourism, recreation, spiritual inspiration, aesthetics, and education).

3.5.4 Growing global ocean economies and sustainable development

Aligning the activities of the growing ocean economy with global policy goals for more sustainable ocean use and conservation does not only improve governmental regulations but also increased cooperation among governments, civil society, scientists and the private sector (OECD, 2012; Patil et al 2018). The context for such engagement with the private sector is a global economy in which consolidation among a small number of transnational corporations (TNCs) has become a dominant feature and where relatively few corporations control a large market share of the overall output or sales for a particular product or service. In the ocean economy, the extent of concentration in the ocean economy (Table 3.4) and the TNCs that function as keystone actors in the ocean is a necessary step toward increasing transparency and accountability for better ocean governance (Virdin et al, 2021). Given their potential to be more flexible and agile than governments (individually or collectively), identifying TNCs whose viability is dependent on ocean use could provide a basis for exploring if such companies are willing to mainstream stewardship principles across their operations to enhance the social and environmental sustainability of the ocean economy.

Table 3.4: Ocean economy industry and revenues for 2018

Industry	Definition	Revenue (USD Billion	Notes
Offshore Oil and gas	Exploration and production of offshore oil and gas, including the operation and maintenance of equipment related to this activity	830 (35%)	This revenue figure does not include onshore oil and gas operation
Marine equipment and construction	Manufacturing of marine equipment and materials	354 (19%)	Examples include machinery, valves, cables, sensors, ship materials, aquaculture supplies, and wind farms
Seafood	Industrial capture fisheries, aquaculture, and fish processing activities.	276 (15%)	Includes farm production of seafood and micro- and macro-algae, economic activity related to catch production, and the preparation and preservation of fish, crustaceans, and mollusks, production of fishmeal for human consumption and animal feed, as well as processing of seaweed. Does not include small-scale or artisanal fisheries
Container shipping	Transportation of containerized freight through the ocean	156 (8%)	Does not include the building and repair of vessels, nor oil and gas cargo, dry bulk cargo, or car carrier/RORO
Shipbuilding and repair	Building, repair, and maintenance of ships and boats	118 (6%)	
Cruise Tourism	Transportation of passengers through the ocean for tourism and recreation purposes	47 (3%)	Serving as a potential measure of ocean-related tourism and recreation activities, although it does not include activities located in a place near or adjoining the coast, which are often aggregated with tourism and recreation data not related to the ocean
Port Activities	Cargo handling, logistics, security, employment, as well as maintenance, development, and construction of port infrastructure	38 (2%)	
Offshore wind	Production of electric power from offshore wind	37 (2%)	Encompasses companies that own and operate offshore wind farms. Offshore wind turbine suppliers are included in the marine equipment and construction industry

Source: Virdin et al (2021).

As shown in Table 3.4, the biggest industry in the Ocean 100 was offshore oil and gas, whose TNCs accounted for approximately 65% of the total revenues, followed by shipping (12%), shipbuilding and repair (8%), maritime equipment and construction (5%), seafood production (4%), cruise tourism (3%), and port activities (2%). Only one TNC in the offshore wind industry was big enough to be included in the Ocean 100 list, generating <1% of total revenues of this group (Virdin et al, 2021). The industries and total revenues show that there is a significant economic contribution that the ocean economy can make especially in emerging and underdeveloped areas like cruise tourism, port activities and offshore wind.

3.6 BRAZIL, RUSSIA, INDIA, CHINA AND SOUTH AFRICA'S (BRICS) AGENDA ON THE OCEAN ECONOMY

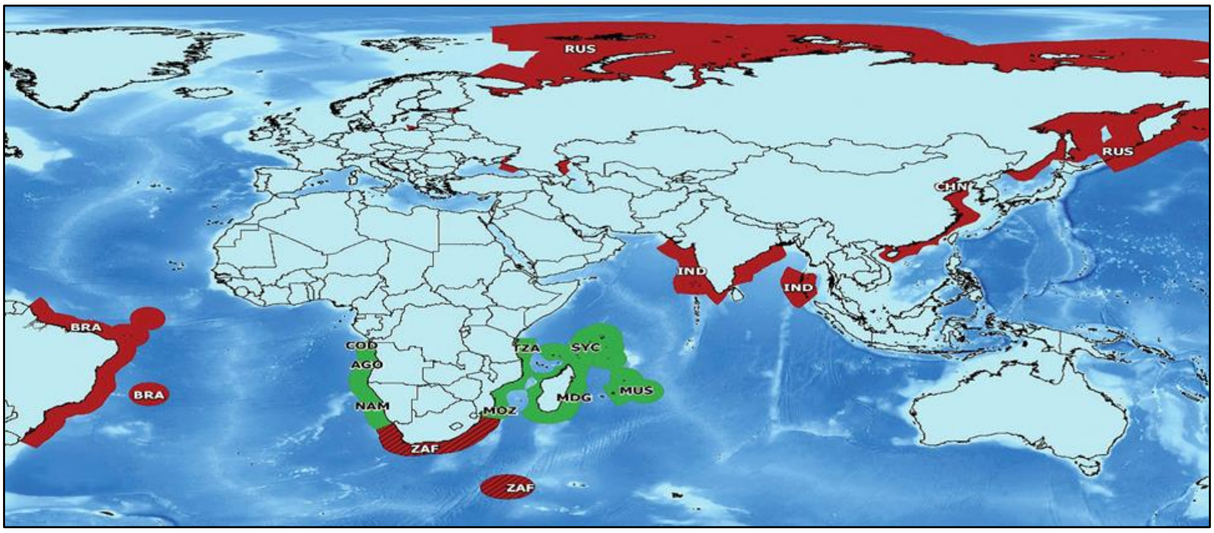
The BRICS economies are coastal states and the constants of geography endow them with enormous economic muscle. The Exclusive Economic Zones (EEZ) provide them with enormous quantities of living and non-living resources and the long coastlines are dotted with major ports. They have invested enormous capital to build maritime infrastructure and some of them are keen to support global projects such as the Maritime Silk Route mooted by China and the development of the Northern Sea Route (NSR) through the Arctic by Russia (Kornegay, 2013a; Vreÿ, 2017). The BRICS countries are highly-dependent on the seas and relate to each other through the Atlantic, Pacific, Indian and the Arctic Oceans over which more than 90% of global trade by volume is transported.

The maritime domain for BRICS (Brazil, Russia, India, China and South Africa), which evolved in 2010, prioritises matters that underpin the use of the oceans in more constructive ways, underlined by the importance of co-operation, and managing the oceans in a manner that promotes sustainability (Petrachenko, 2012:74 in Vreÿ, 2017). The formation of BRICS, aimed at promoting cooperation and international groupings, comes at an important time when reinforcing maritime security governance and co-operation in the respective oceans remains high on the global agenda. Among the BRICS countries of Brazil, Russia, India, China and South Africa, South Africa has the highest income inequality index, a Gini index of 0.63, and the highest global ranking as the fourth unequal country in the world (World Bank, 2016). Brazil comes second with a Gini index of 0.55 and a global rank of 13. China, Russia and India follow in the far distance, although the latest data available for China and India was from 2005 (World Bank, 2016). In terms of GDP growth, South Africa's GDP is only a third of Russia and Brazil's GDP and a fraction of China's and India's GDP (Vreÿ, 2017). However, trade as a percentage of GDP in South Africa is actually the highest as an indication of openness in an economy amongst the BRICS economies (World Bank, 2016, Vreÿ, 2017).

The maritime connection implies competition and co-operation within BRICS, as well as with other maritime actors (state and non-state) to promote responsible use of the oceans and maritime governance (Kornegay, 2013a). As a global common, the ocean is there for all to use in a competitive or co-operative manner and preferably within the ambit of the United Nations Convention on Law of the Sea (UNCLOS, 1982). Kraska (2011), however, views BRICS as a catalyst for disputing rules as well as promoting cooperation and economic growth among the BRICS countries, which can be beneficial for ocean economy growth.

The geographic positioning of BRICS countries as coastal states from three continents with interconnecting oceans is an important physical nexus (Vreÿ, 2017). As BRICS members occupy five of the top 16 largest maritime Exclusive Economic Zones (EEZs), concerted action from BRICS members to benefit more from their vast maritime domains is to be expected (Kraska 2011:114). As shown in Figure 3.6, the four BRICS countries collectively hold potential influence over the Arctic Sea (Russia), the Western Pacific (China and Russia), the Indian Ocean (India), and the western sphere of the South Atlantic (Brazil) (Flugel, 2017). The BRICS maritime nexus ultimately runs via national maritime territories, claimed economic zones, and the high seas to connect centres of production and consumption, thus, the imperative of security at sea to support an interconnected system of sea trade for BRICS members (Flugel, 2017). However, Vreÿ (2017) concludes that a maritime BRICS receives scant attention in the literature and narratives that depict the general BRICS agenda.

Figure 3.6: Exclusive Economic Zones (EEZs) of the four BRICS countries (highlighted in red)



Source: Flugel (2017).

Vivero and Mateos (2010) present an overview of the BRIC maritime profile by emphasising their combined maritime territory, but also geopolitics as an indelible maritime component. As shown in Figure 3.6, the four BRIC countries collectively hold potential influence over the Arctic Sea (Russia), the Western Pacific (China and Russia), the Indian Ocean (India), and the western sphere of the South Atlantic (Brazil) (Vivero & Mateos, 2010:970-972). Even without South African membership, Vivero and Mateos (2010) estimated that by 2010, BRIC already represented a future economic entity of note and one with political power to follow in its wake. Even the initial BRIC grouping (before South African membership) harboured the potential of becoming a major player through its influence (real and potential) over important maritime settings, facilities, and future opportunities.

BRICS countries own the largest single and combined fleets of fishing and trade vessels that sail the oceans, highlighting the importance of co-operating towards secure sea lanes across the oceans and upholding the rules that regulate these highways. While Borchard (2014:21), for example, points out the general growth of maritime trade by way of shipping flows and growth, in particular, as well as aspects such as harbours and container freight, Flugel (2017) tie these to BRIC(S) and the rise of container mega-ports, of which 21 out of the top 100 are found in Brazil (1), China (17), India (2) and Russia (1) amidst rapid growth rates in their handling of cargo.

Mega-containerisation is impressive, but its most essential need is securing the sea as a flow resource for optimal trading in containerised goods, but also strategic goods such as energy resources. The idea of a blue BRICS is not without its stumbling blocks and opposition (Vrëy, 2017). Whereas many of these concerns pertain to the softer security aspect of the BRICS maritime connection, a certain competition and even threat environment constituted by other state actors coexists with the co-operative security realm.

China's rise towards a future superpower holds disturbing indicators of possible military confrontation and one hardly exclusive of naval ambitions. Trade, growth, the role of maritime trade routes, and the rise of economic zones on the coast turned Chinese defence attention off-shore and the imperative to raise its naval profile in defence against aggression from the sea, protect national sovereignty, and safeguard maritime rights (Van der Veen, 2013:37; Kynge et al, 2017). Within BRICS, China, unfortunately, also has a less than amicable relationship with India, the other rising power in BRICS, and one characterised by maritime competition. Then there is the 2015 Chinese fishing trawler incident in waters of South Africa, a fellow BRICS member, which resulted in the SA Navy entering the chase and fines imposed on the flotilla of Chinese vessels. The incident ironically coincided with a visiting Chinese naval task force arriving in Cape Town, South Africa.

India views stability in the Indian Ocean as a priority. India's economic rise is sea dependent, its long coastline connecting with the Indian Ocean, which explains India's focus on this particular ocean region. The Indian Navy serves to have a both foreign and onshore influence and to support a host of economic activities unfolding in the Indian Ocean. India's view of keeping the Indian Ocean free of foreign influence and possible military confrontation is challenged by the roles of Pakistan and China and their intrusions into this maritime region (Van der Veen, 2013:49). This competition with naval undertones holds an element of inter-BRICS tensions, but the Indian Ocean remains important for China, India and South Africa through their physical littoral presence and geographical proximity as well as for naval purposes.

3.7 AFRICA'S OCEAN ECONOMY

The African Union (AU) recognises the importance of the ocean economy of Africa and how the ocean economy can contribute to the continent's development. The African Union's Agenda 2063 determines the maritime economy as a major contributor to growth. This growth potential is further acknowledged through Africa's Integrated Maritime Strategy 2050 - AIMS, 2050 (African Union, 2014), which recognises the vast wealth creation potential of Africa's oceans, lakes and rivers. Africa's maritime transport demand and supply patterns underscore the potential of African countries both as users and providers of maritime transport services. Regions in Africa can do this by leveraging growth prospects and building on comparative advantages like abundant low-cost labour and long coasts to house maritime business industries (Savela, Salahub, Keinänen-Toivola, 2018; UNCTAD, 2018). Africa's container ports and hinterland transport networks need to support these efforts by continuously upgrading infrastructure and services, and improving performance, to match international standards (Programme for Infrastructure Development in Africa, 2011). Governments within SADC continue to realise the importance of research and public-private sector partnerships in ports, shipping and logistics (SADC, 2012; Savela et al, 2018).

3.7.1 Continental perspectives

According to the Economic Commission for Africa (2016), over the past decade Africa has developed fast and shown good progress, recording an average of 4 to 5% growth in GDP, despite a recent unfavourable international economic and financial environment. Six of the world's ten fastest-growing economies are in Africa. However, the Economic Commission for Africa (2016:3) finds that "Despite Africa's rich resource endowments, the continent still suffers from large-scale poverty, with 46% of the population living in extreme poverty". Projections depict that Africa will account for much of the exponential growth in the world's population this century, and a quarter of the population on Earth in 2050 will be from Africa (Economic Commission for Africa, 2016).

The African Union defines the ocean economy as "sustainable economic development of oceans using such techniques as regional development to integrate the use of seas and oceans, coasts, lakes, rivers and underground water for economic purposes, including, but without being limited to fisheries, mining, energy, aquaculture and maritime transport, while protecting the sea to improve social well-being" (2013). The definition highlights the features that make the ocean economy more locally-based and more resilient, to minimise the likelihood of shocks such as economic or environmental disturbances developing into regional or even global crises, as is presently the case (UNEP, 2013; OECD, 2016). For three-quarters of the African continent, the ocean economy is its principal economy and, if well used, could be an effective engine for economic growth (African Union, 2013).

Hailed by the African Union (AU) as the "new frontier of African renaissance", the blue economy and its potential as an economic resource is gaining prominence across the continent. Africa stands to reap maximum benefits of utilising its seas, oceans and their resources for sustainable economic development (African Union, 2014: 11). A substantial part of Africa's economic growth relies on numerous ocean-related activities. Maritime zones under Africa's jurisdiction cover about 13 million square kilometres including approximately 6.5 million square kilometres over the continental shelf. Moreover, 38 out of the 54 African countries are coastal states and the continent is host to globally-acclaimed islands including Mauritius, Comoros, Seychelles and Madagascar. Africa's inland waters, oceans and seas, offer an immense wealth of resources (fishing, minerals and energy), representing significant economic opportunities and, in some instances, real alternatives to many heavily exploited land-based resources. The blue economy holds great potential for the socio-economic development of the African continent and, accordingly, it has gained an important place on regional and national development agendas. The 2050 Africa's Integrated Maritime Strategy developed by the AU is the strategic document setting out the continent's socio-economic targets for decades to come, identifies the blue economy as a significant accelerator for the continent's quest for economic transformation and sustainable development.

Furthermore, the AU's 2050 Africa's Integrated Maritime (AIM) Strategy provides a broad framework for the protection and sustainable exploitation of the Africa's Maritime Domain (AMD). Its overarching vision is to foster increased wealth creation from Africa's oceans, seas and inland waters by developing a sustainable thriving blue economy in a secure and environmentally sustainable manner. One of the key goals of the strategy is to ensure synergies and coherence between sectoral policies within and between Regional Economic Communities (RECs) by adopting a common and cooperative approach to maritime issues to contribute to the creation of sustainable growth from sea- or maritime-related activities

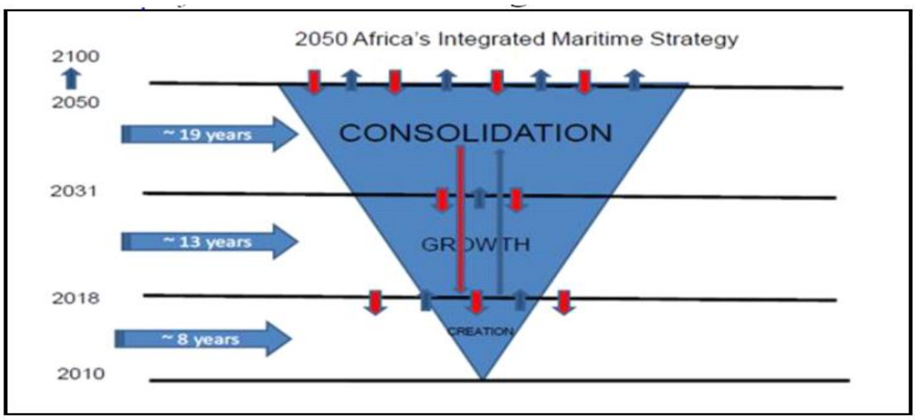
The new and developing industries in the ocean economy include but are not limited to aquaculture, marine renewable energy technologies for wind, wave and tidal energy, bio-products (pharmaceutical and agrichemical), blue or ocean carbon (carbon storage in mangroves, seagrass and saltmarsh) and seawater desalination. The ocean economy open doors for Africa’s industrialisation and economic development. Fresh water and marine fish contribute to the food security of over 200 million people in Africa and provide an income for over 10 million people (UNEP, 2013). In May 2014, the African Union estimated the first-sale value of African fisheries (marine, inland and aquaculture) to be US$19.7 billion per annum. It also estimated that there would be an additional US$2 billion available annually for African economies if the fisheries sector were to be managed sustainably (African Union, 2014). A previous study from the World Bank (2012) confirms that Africa has a serious infrastructure deficit, estimated at about US$48 billion a year, and that this deficit is impeding the continent’s competitiveness and hence its economic growth, to the value of 1 or 2% of gross domestic product (GDP) per year.

3.7.2 Desirable ocean economy framework for Africa

Regarding a desirable ocean economy framework for Africa, there is a great deal of hope, because certain ocean and aquatic resources are potentially renewable given the proper mechanisms, and a country can achieve economic growth without depleting resources or making its communities vulnerable (Spamer, 2015). To make a community resilient is to empower its members to generate wealth using locally-available resources, which Africa still has in abundance, and to do so without exposing themselves to dangers resulting from their activities (FAO, 2014). From an African perspective, the AU’s Agenda 2063 aims at “a prosperous Africa based on inclusive growth and sustainable development” (African Union, 2014: 43). On prospects for the continent’s blue economy, it outlines that “Africa’s … ocean economy, which is three times the size of its landmass, shall be a major contributor to continental transformation and growth" (African Union, 2014; Walker, 2015).

One goal of the AU's 2050 Africa's Integrated Maritime Strategy (AIMS 2050) is to encourage states to create a blue economy that would foster wealth creation through coordinated and sustainable maritime industries, such as fishing, shipping and resource extraction. The 2050 Africa's Integrated Maritime Strategy (AIMS 2050) addresses Africa's maritime challenges for sustainable development and competitiveness and the strategy's overarching vision "is to foster increased wealth creation from Africa's oceans and seas by developing a sustainable thriving blue economy in a secure and environmentally sustainable manner" (African Union, 2014: 14). The strategy is made up by three distinctive periods, the first spanning from 2010 to 2018 is called the "creation" phase, which will focus on the development of a sound prioritisation scheme. This will be followed by a thirteen-year period of "growth" with the last period of "consolidation" taking the calendar to 2050 and beyond as illustrated in Figure 3.7.

Figure 3.7: AIM Strategy calendar from 2010 to 2100



Source: Spamer (2015).

Africa believes that the ocean economy is key in connecting and stimulating the emergence of integrated productive sectors for economic and social development. This will allow the continent to develop a sustainable circular economy, where each ocean economy component is developed in harmony with the preservation and conservation of the environment as envisaged in the Africa Integrated Maritime Strategy 2050 (African Union, 2012). The territorial waters and exclusive economic zones (EEZs) under the jurisdiction of African Coastal States (39 out of Africa's 54 countries are coastal and island states) are extensive, measuring some 13 million km², and their continental shelves extend over a total area of some 6.5 million km². With an area of approximately 30 million km², Africa is the second largest continent, equivalent to two-thirds of the size of Asia, and three times that of Europe. The continent is surrounded by oceanic expanses (Atlantic Ocean and Indian Ocean), and by two semi-enclosed seas, namely, the Mediterranean Sea and the Red Sea. The continent, therefore, has a vast ocean resource base that can contribute to sustainable development of the coastal nations within Africa.

The ocean economy has the potential to create wealth and economic growth and to transform the lives of Africa's citizens. Africa is endowed with a variety of natural resources, living and non-living, such as water and diverse flora and fauna, including fish stocks, minerals and hydrocarbons (African Union, 2014; Spamer, 2015; OECD, 2016; Walker, 2018). The wealth that can be generated from the ocean is conservatively valued at US$ 4 trillion, which is equivalent to the GDP of countries in East Asia and the Pacific in 2017, of which it is estimated goods and services provide $2.5 trillion annually (World Bank, 2018). The need for personal and collective ownership and collaborative decision-making is important. There is a particular need to bring in the voices of those traditionally-marginalised groups that are often not included in knowledge creation and decision-making processes, such as the extreme poor, women and youth (United Nations Economic Commission for Africa, 2016). As an example, African countries have the opportunity to utilise and apply Marine Spatial Planning (MSP), which is an integrative, adaptive, and participatory process that brings together multiple users of the ocean at various levels, including energy, industry, fisheries, oil and gas, government, conservation and recreation, to make informed and coordinated decisions about how to use marine resources sustainably.

The increasingly intense use of the oceans and seas in several economic sectors, combined with the impact of climate change, has added to the pressure on the marine environment (United Nations Economic Commission for Africa, 2016). In addition, a large part of the African population lives in coastal areas, and with most African coastal countries undergoing rapid population growth, urbanisation, coastward migration and associated socio-economic growth, countries are experiencing dramatic coastal change, with increased pressure on marine resources. Other challenges that negatively impact the ocean economy within the African continent include threats such as piracy and armed robbery, the trafficking of people, illicit narcotics and weapons, as well as *natural* threats from tsunamis and hurricanes, and rising sea levels and ocean acidification (United Nations Economic Commission for Africa, 2016). Overfishing caused by illegal, unreported and unregulated (IUU) fishing and other unsustainable fishing practices also pose a serious problem in the region, along with pollution and habitat destruction.

3.8 GLOBAL OCEAN ECONOMY TOWARDS 2060

The GVA of the global ocean economy (as defined by the OECD) is projected to double to $3 trillion by 2030 (OECD, 2016). The WWF (2015a) report depicts that more than two-thirds of the annual base economic value of the ocean is produced by assets that rely directly on healthy ocean conditions. Given the US$24 trillion, the value of key ocean assets is conservatively estimated to be at least US$24 trillion call to action (WWF, 2015a; OECD, 2016). The evidence is clear that the ocean is a major contributor to the global economy, but its asset base is being rapidly eroded. The OECD (2016) and WEF (2017) further confirm that more global trade, which is primarily maritime, is projected to double by 2030. This will lead to busier sea routes, which will challenge marine spatial planning, especially in parts of the sea with multiple usages (OECD, 2016). The emergence of completely new sectors, such as deep-sea mining, and the rapid growth of others, such as aquaculture and offshore renewable energy, will continue to be on the rise as the future of the ocean economy is approached (OECD, 2016).

The global population is projected to grow to 9.8 billion by 2050 (World Bank, 2018). The growth in population will directly affect the demand for energy to almost twice as what is required now, while food and water demand will increase by over 50% (OECD, 2016, World Bank, 2018). It is also estimated that by 2050, the demand for minerals may increase by 25%. The World Bank (2018) further cites that twelve of the world’s 16 largest cities are within 100 km of the sea and the average population density is three times higher by the coast and growing as a result of urbanisation (large cities tend to be coastal). This is likely to increase pollution, fishing levels and vulnerability to sea level rise (IPCC, 2014; OECD, 2016; Visbeck et al, 2017; World Bank, 2018).

The combination could have implications for environmental sustainability and potential knock-on effects for coastal states as more people move towards coastal areas placing more pressure on the future of the ocean economy.

The WWF (2015b) report emphasises the importance of restoring the ocean’s productive capacity before it is too late and requires the world to take urgent action. The first priority must be for all countries to commit to increase efforts that will promote effective conservation of coastal and marine habitat in their jurisdictions, and to support a global agreement on sustainable development at the United Nations that reflects this resolve and shared responsibility (WWF, 2015b; OECD, 2016). A crucial year to forge this global effort and to see action to reduce the worst impacts of climate change was 2015. However, these actions will help to revive the ocean and its powerhouse economy (WWF, 2015b).

A busy and a complex future has been anticipated for the ocean economy, as new technologies open it up for greater exploration and exploitation. Its resources will be more in demand from a growing global population. Globally, its environment is expected to be transformed by climate change, with major implications for the industries and communities that depend on it (UK Government Foresight Future of the Sea Project, 2017). In 2015, reviving the ocean economy was the case for action, showing strong evidence that major ocean assets have been in steep decline for decades and, in some cases, the ocean economy is already faltering and not delivering anything like its full potential (Visbeck et al, 2015; OECD, 2016; United Nations 2018). This comes at a time when the need for food and resources from the ocean is increasing rapidly. The ocean is changing faster than at any other point in tens of millions of years. There is a real chance that the many ocean systems may be pushed beyond the point of no return, seriously constraining options for the children and for generations to come. In some cases, such as ocean acidification, it will take tens of thousands of years (or hundreds of generations of people) for the ocean to repair itself. In the case of species extinction, the impact will be permanent, and there is no going back (WWF, 2015a). The growth in human population means restoring the ocean economy and its core assets is a matter of global urgency, but the list of ocean systems under heavy pressure is already long and growing.

Table 3.5 lists the type of activities and components within the ocean economy and shows the cycle at which the activity is at based on established, new or introduction and emerging industries.

Table 3.5: Components of the ocean economy

Type of activity	Ocean service	Established industries	New industries	Emerging industries	Drivers
Harvesting of living resources	Seafood	Fisheries	Sustainable fisheries		Food security Demand for protein
			Aquaculture	Multi-species Aquaculture	
	Marine bio-technology		Pharmaceuticals, chemicals		R&D in healthcare and industry
Extraction of non-living resources, generation of new resources	Minerals	Seabed mining			Demand for minerals
			Deep seabed mining		
	Energy	Oil and gas			Demand for alternative energy sources
			Renewables		
	Fresh water		Desalination		Freshwater shortages
Commerce and trade in and around the ocean	Transport and trade	Shipping			Growth in seaborne trade International regulations
		Port infrastructure and services			
	Tourism and recreation	Tourism			Growth of global tourism
		Coastal development			Coastal urbanisation
			Eco-tourism		Domestic regulations
Response to ocean health challenges	Ocean monitoring and surveillance		Technology and R&D		R&D in ocean technologies

Type of activity	Ocean service	Established industries	New industries	Emerging industries	Drivers
	Carbon sequestration		Blue carbon (i.e. coastal vegetated habitats)		Growth in coastal and ocean protection and conservation activities
	Coastal protection		Habitat protection, restoration		
	Waste disposal			Assimilation of nutrients, solid waste	

Source: Economist Intelligence Unit (2015).

The areas identified in Table 3.5 are based on living and non-living ocean resources, commerce and trade as well as ocean health challenges, which remain key for a sustainable ocean economy future. Towards 2060, an integrated and a coordinated approach for new and emerging industries will remain key.

3.8.1 Population trends in coastal cities

Coastal areas favour concentration of population. Migration is a key factor affecting coastal zones. The figures in China and Southeast Asia are staggering, namely, 1 000 people arrive in China's large coastal cities each day, and similar numbers move to the coasts in Vietnam and the Philippines (Creel, 2003). Among other reasons as to why people migrate to coastal cities, the marine environment facilitates certain leisure and economic growth activities such as fishing, industry, tourism and transportation (OECD, 2016). WWF-SA (2016) further note that coastal population growth and urbanisation rates are outstripping the demographic development of the hinterland, driven by rapid economic growth and coastward migration toward low-elevation coastal zone (LECZ). Many of the world's coasts are becoming increasingly urban. Creel (2003) identify that 14 of the world's 17 largest cities are located along coasts. Eleven of these cities, including Bangkok, Jakarta and Shanghai, are in Asia. In addition, two-fifths of cities with populations of 1 million to 10 million people are located near coastlines (Creel, 2003; OECD, 2016).

3.8.2 Food security

Fish and fish products are an important sector of global trade. In 2013, total world exports of fish and fishery products were estimated to reach US$136 billion, showing an average of 12% annual increase over the prior 10 years (FAO, 2016). Most of these exports are driven by the demand in developed countries, which account for more than 75% of global fish imports (FAO, 2016; Visbeck et al, 2017). It is anticipated that demand from Asia will grow at a rate comparable to that of demand from developed country markets (UNCTAD, 2018). This is partly the consequence of dwindling fisheries stocks available in neighbouring seas of industrialised countries owing to excessive exploitation over the last 200 years. For many people in developing countries, fish and other seafood caught by small-scale fishers are particularly important for their health. Without it, many could not afford to eat enough proteins, omega-3 fatty acids, or essential micronutrients such as vitamin A, iron, calcium, vitamin D, zinc and iodine on a regular basis (FAO, 2016). Securing Sustainable Small-Scale Fisheries (SSF) in the Context of Food Security and Poverty Eradication (SSF Guidelines) are the first international instrument dedicated entirely to the immensely important small-scale fisheries sector that was introduced by FAO in the year 2011 (FAO, 2017). This was a first attempt to synthesise information on the diverse and misreported livelihood and economic contributions of capture fisheries globally. The project produced detailed case studies from countries with important inland and marine small-scale fisheries and used these to estimate global contributions. The case study approach followed on *Hidden Harvest* engages local expertise in priority countries that have substantial small-scale fisheries sectors or notable nutritional dependence on small-scale fisheries. The study will be finalised end of 2021 (FAO, 2017).

3.8.3 Energy demands

The International Energy Agency (2018) anticipates that demand for renewable energy is expected to increase two-and-a-half times by 2035.The generation of renewable energy from tides and waves, wind turbines located in offshore areas, submarine geothermal resources and marine biomass could be viable alternatives for contributing to energy needs and climate change mitigation objectives (OECD, 2016, International Energy Agency, 2018, Belleti and McBride, 2021). Of all the marine sources, the highest potential for electricity generation is in the offshore wind turbines sector. The International Energy Agency (2018) reports that global offshore wind capacity is growing at the incredible rate of 40% per year, producing 7,100 megawatts of electricity by 2020. In the EU, offshore wind already represents about 10% of the total renewable energy produced and is expected to reach about 20% by 2030 (Roney, 2014, International Energy Agency, 2018, Belleti and McBride, 2021). This has been possible due to significant green industrial policies and public support. Energy generation from tides, waves and submarine geothermal sources are in the early development stages and may become commercially viable within the next 10 years (OECD, 2016; World Ocean Summit, 2021).

3.8.4 Ports, transport and logistics

About half of the world's population, most of its largest cities and industries along with critical value chains tend to be concentrated in coastal areas to ensure access to transport routes and continuous flows of resources and products (Creel, 2003; UNCTAD, 2013). UNCTAD (2013) confirms that between 80 and 90% of the volume of global trade is transported by sea. In 2012, about 9.2 billion tons of goods were loaded in ports worldwide (OECD, 2012). Without oceanic and sea routes, globalisation as we know it would not have been possible (Creel, 2003; UNCTAD, 2013; OECD, 2016). Growth in international maritime trade stalled in 2019, negatively affecting ports, transport and logistics and reaching its lowest level since the global financial crisis of 2008-2009 (UNCTAD, 2020a). Lingering trade tensions and high policy uncertainty undermined growth in global economic output and merchandise trade and, by extension, maritime trade. As per the UNCTAD (2020a) report, maritime trade volumes expanded by 0.5%, down from 2.8% in 2018 and reached a total of 11.08 billion tons in 2019. Growth in world gross domestic product slowed to 2.5%, down from 3.1% in 2018 and 1.1 percentage point below the historical average over the 2001-2008 period (UNCTAD, 2020a). In tandem, global merchandise trade contracted by 0.5%, as manufacturing activity came under pressure and the negative impact of trade tensions between the two largest world economies took a toll on investment and trade. Against the backdrop of a weaker 2019, the short-term prospects of maritime transport and trade darkened in early 2020. While initial expectations were that 2020 would bring moderate improvements in the economy and trade, the unprecedented global health and economic crisis triggered by the COVID-19 pandemic severely affected the outlook and the effects will be felt for many years to come leading up to 2060.

3.8.5 Maritime education and ocean research

Education, science and research has a crucial role in determining how successfully the world manages many long-term challenges and opportunities that the ocean economy presents (OECD, 2016; Foresight Future of the Sea, 2017). Education and ocean research prospects primarily relate to understanding global-scale change, variability and impacts, identifying new marine resources and the implications of their exploitation, improving predictive capability for hazards and disasters, and developing transformational new technologies to facilitate new activity at sea.

The OECD (2019) identified various key long-term trends for maritime education and ocean research, namely:

- Rapid, poorly-understood changes to the sea. There is currently insufficient evidence to understand the full implications of the chemical, biological and physical changes described in this report.
- Big data and modelling. Industry projects a 40-fold increase in the amount of data collected annually by 2020. In the sea, this will be supplemented by autonomous vehicles that allow for more regular data collection and greater access to the deep sea and other inhospitable marine environments. This has implications for understanding and modelling of the marine environment, and for the economy.
- Climate change threat. This is likely to increase demand for science and research to address uncertainty about its impacts.
- Demand for technological solutions to enable autonomy. Autonomy is likely to be the single most important marine technological development. There are a range of challenges associated with introducing autonomy, including a need for improved battery technology, electric propulsion technology, data transfer and inter-device connectivity.

3.8.6 Marine and coastal tourism

In 2012, for the first time, the number of international tourist arrivals reached over 1 billion, with approximately one out of every two tourists visiting the seaside (United Nations World Tourism Organization, 2013). However, marine and coastal tourism is particularly vulnerable to climate change, natural disasters and pollution. The sea level rise anticipated from climate change is the biggest long-term threat facing the tourism industry, especially in areas where most tourism infrastructure lies just above sea level. In the short-term, unmanaged mass tourism can negatively impact coastal ecosystems. Sustainable tourism, including ecotourism, can have a significant impact on the recovery and conservation of these ecosystems. Tourists are starting to pay attention to ecological standards and certifications applying not only to destinations and the tourism infrastructure but also to hotels and the behaviour of tourism and transport operators. Sustainable tourism could be introduced as part of sustainable investment and infrastructure policies, marine and coastal zone management plans and, depending on its impact, could also be linked to the sustainable use of marine protected areas.

3.8.7 Innovation and technology

Future developments in technology will change the way in which the maritime sector operates, driving performance enhancements and creating opportunities for ocean industries and businesses to take better decisions. Big data analytics, digitalisation and more advanced communications will lead to better connectivity, efficiency gains and cost savings but also present risks to business continuity such as through cyberattack (UK Department of Transport, 2019). Advances in autonomy and other technologies are expected to fundamentally change employment in some marine sectors, and create new opportunities to safely and efficiently explore, monitor and work at sea (Government Office for Science, 2017). This function is supported by technology developments in robotics and artificial intelligence.

The OECD (2019) identified various key long-term trends for technologies within the ocean economy including:

- Increasing reliance on satellites and data sharing. New opportunities from autonomy are likely to increase reliance on satellite technology at sea and create a growing market for data-sharing infrastructure.
- Opportunities from biotechnology. New research and technological innovation are enabling greater innovations in biotechnology. The potential benefits include growing opportunities to use genetic resources in cosmetics and pharmaceuticals.
- Increasing cyber security exposure and risks. This area is not excluded from the overall trend for increasing global cyber security risk, with threats particularly linked to the growing reliance on digital and autonomous systems.
- Alternative fuels for shipping. In the absence of new technologies to reduce emissions, global shipping could be responsible for up to 17 % of carbon emissions by 2050. Industry has identified a growing demand for cleaner fuels and a subsequent search for alternative fuels as one of the major trends affecting ocean transportation.

3.8.8 Ocean environment

The ocean environment is facing unprecedented change as a result of direct human activity and climate change. Based on current projections, these challenges will have major implications for global biodiversity, infrastructure, human health and wellbeing and the productivity of the marine economy (OECD, 2016). Various key long-term trends have been identified for the ocean environment:

- Marine biodiversity will face growing threats linked to human activities. Over-exploitation is the key threat but will be compounded by climate change. The decline and, in some cases, extinction of marine organisms will damage the long-term health of the oceans and its services, such as carbon sequestration and food provision.
- Sea level rise is expected to increase the regularity of coastal flooding (especially when coupled with extreme weather events), affecting transport networks, housing and other important infrastructure.
- Ocean warming of 1.2-3.2°C, depending on emissions, is projected by 2100. Evidence shows that this causes decline in cold-water fish species, coral

bleaching, and is likely to lead to new species-specific places across the world and changing habitat.

- Plastic in the ocean is projected to treble between 2015 and 2025. Plastic does not decompose, instead breaking down into ever smaller pieces. The full effects are not restricting their movement, as well as polluting beaches.
- Chemical pollution is an ongoing issue, as pollutants can persist in the oceans for decades after their use is restricted by legislation. The list of chemicals deemed to be persistent organic pollutants (POPs) continues to grow.

In addition to the long-term trends and unprecedent ocean environmental changes, there are two broad challenges that will impact the future of a sustainable ocean economy. The two challenges are climate change and pollution.

3.8.8.1 Climate change

The ocean and coasts provide critical ecosystem services such as carbon storage, oxygen generation, food and income generation (IUCN, 2015). Coastal ecosystems like mangroves, salt marshes and seagrasses play a vital role in carbon storage and sequestration. When these ecosystems are degraded, lost or converted, massive amounts of CO_2, an estimated 0.15-1.02 billion tons every year, are released into the atmosphere or ocean, accounting for up to 19% of global carbon emissions from deforestation. The ecosystem services such as flood and storm protection that they provide are also lost.

3.8.8.2 Pollution

Advancements in science and technology, population growth, shifting consumer preferences and environmental impacts are widely-acknowledged as key drivers of change within the ocean economy (OECD, 2016). To enhance the long-term development prospects of emerging ocean industries and their contribution to growth and employment, while managing the ocean in responsible, sustainable ways, the OECD (2016) proposed four recommendations that include, in particular, areas in which the OECD is well-positioned to make a useful contribution to international efforts. The OEDC (2016) recommends that the areas on which policymakers would need to focus to enhance the ocean economy towards 2060 include:

a) Fostering greater international co-operation in maritime science and technology as a means to stimulate innovation and strengthen the sustainable development of the ocean economy. This would involve, for example, undertaking international comparative analyses and reviews of the role of government policy on technological innovations in marine and maritime activities.

b) Strengthening integrated ocean management. In particular, this should involve making greater use of economic analysis and economic tools in integrated ocean management, for example, by establishing international platforms for the exchange of knowledge, experience and best practice, and by stepping up efforts to evaluate the economic effectiveness of public investment in marine research and observation.

c) Improving the statistical and methodological base at national and international level for measuring the scale and performance of ocean-based industries and their contribution to the overall economy. This could include, among other tasks, the further development of the OECD's Ocean Economy Database.

d) Building more national and international capacity for ocean industry foresight, including the assessment of future changes in ocean-based industries.

The ocean environment is very important for promoting a sustainable ocean economy, as it provides all the natural resources and the aesthetic benefits associated with the ocean economy and protecting and preserving the ocean is key for a sustainable future.

3.9 CHALLENGES IN DEVELOPING A SUSTAINABLE OCEAN ECONOMY

The ocean provides food for many, often poor, coastal communities, provides jobs, energy, and raw materials, enables global trade as well as recreational and cultural services. Yet, developing and growing the ocean economy is becoming a serious challenge as marine resources are essential to help meet the planet's growing needs in food, energy, jobs, medicines and transport (OECD, 2019). On the other hand, increasing the use of seas and ocean, the natural resources and the services they provide, adds to mounting pressures on marine ecosystems. The marine environment is already straining under the weight of pollution, rising water temperatures, loss of biodiversity, rising sea levels, growing acidification and other impacts associated with climate change, with the result that unsustainable growth in ocean-related economic activity risks yet further undermining the very foundations on which the ocean economy stands. Sections 3.9.1 to 3.9.4 highlight the major challenges that could potentially hinder the development of a sustainable ocean economy in the next 20 to 30 years.

3.9.1 Pollution

Visbeck and Schneider (2018) cite that rapidly-growing, prosperous and technologically more-advanced societies are increasingly impacting the local and the global ocean environment, leading to pollution by both chemical and physical wastes. Eighty per cent of ocean pollution is from land sources, such as industrial and agricultural run-off, plastics pollution, heavy metals (especially mercury) from coal-fired power stations, and carbon dioxide and other harmful greenhouse gases from the transport sector (OECD, 2016; WEF, 2017; Unger et al, 2017). The WEF (2017) reports that ocean chemistry is changing faster than at any point in perhaps 300 million years, in particular, owing to the absorption through solution in seawater each year of around 30% of anthropocentric CO_2 gas pollution. The damage this is causing through rising acidification is creating an unprecedented and unpredictable impact on ocean life that cannot be easily reversed (IPCC, 2014; OECD, 2016; WEF, 2017; Unger et al, 2017).

3.9.2 Illegal, unreported and unregulated fishing

Overfishing is contributing to the rapid decline of many fish species and fish stocks. In 2016, the FAO estimated that almost a third of global fish stocks are overfished (FAO, 2016). The FAO (2016) further reported that there is a one in five chance that any item of seafood purchased nowadays has been fished illegally. IUU fishing is theft, and, currently, takes $24 billion a year of revenue away from nations where fisheries sustain important livelihoods, often in developing countries and small island states (FAO, 2016). This is about 20% of the $120 billion global seafood market (FAO, 2016; WEF, 2017). This poses a threat to a sustainable ocean economy as the scale of Illegal, Unreported and Unregulated (IUU) fishing is increasing, which is a key driver of overfishing. African countries need to confront the broader problem, that the extent and impact of maritime crime is frequently transnational in nature, as comprehensively set out in the AIM Strategy - 2050 (Walker, 2015). The AIM Strategy aims to address issues beyond piracy to produce a comprehensive picture based on an expanded concept of maritime security (Walker, 2015).

3.9.3 Climate change

Like CO_2, heat is transferred from the atmosphere to the ocean at the air-water boundary and the ocean is a primary storage medium for both (National Oceanic and Atmospheric Administration - NOAA, 2016; WEF, 2017). NOAA (2016) further confirms that more heat is stored in just the first 10 feet of the ocean than in the entire atmosphere. However, ocean temperatures are rising. According to NOAA (2017), the average sea surface temperature has been consistently higher during the past three decades than at any other time since reliable observations began in 1880.

Ocean acidification refers to increasing levels of dissolved carbon dioxide in the ocean. This holds out the possibility of significant impacts on both marine biodiversity and ecosystems. It diminishes the ocean's capacity to act as the earth's biggest carbon sink (NOAA, 2017). This reduced ability of the ocean to absorb atmospheric carbon will contribute to increased risk to atmosphere and land ecosystems by increasing the rate of climate change. An early indication of increased ocean acidification is that some species of shelled marine organisms cannot effectively produce their shells (NOAA, 2017; Engel, 2018). Ecosystem functions include those ecosystem level processes that contribute to the wellbeing of humans and the planet. Beneficial ecosystem functions (such as the formation of soil; the provision of food, fresh water, wood, fibre and fuel; the regulation of climate, floods and the spread of disease; protection from storm surges and floods; and a range of cultural, spiritual, educational and recreational services) are called ecosystem services (IPCC, 2014). It is estimated that the ocean accounts for about two-thirds of the value of ecosystem services on a global basis. As a result, ecosystems are important for coastal and ocean management. Ocean environmental management provides a balance between maintaining productivity and biodiversity in an ecosystem and optimising the yield of marine resources. This is a key objective for sustainable development (NOAA, 2017; Engel, 2018).

Not only are global populations dumping large amounts of plastic waste into the oceans, but also the insensibility of over-fishing many species are a growing concern (United Nations, 2018). By 2050, there could be more plastic in the ocean, by weight, than fish, according to the Ellen MacArthur Foundation, an organisation that advocates sustainable business practices. In addressing these challenges, numerous international organisations are involved in efforts to address the challenges of sustainable use of the ocean (UNEP, 2003; OECD, 2016; IUCN, 2015; UNDP, 2015). The OECD (2016), while contributing at international policy level to specific aspects of ocean-related issues such as fisheries, shipbuilding, marine biodiversity and biotechnology, has to date not turned its attention to economic activities in the ocean more broadly. The main challenges range from the availability of additional sites and better management of fish stocks, combating pollution from ships and land-based sources, to dealing with the effects of climate change and reducing animal protein in feed based on wild fish catch (UNEP, 2003; OECD, 2016; FAO, 2016). Over-exploitation, pollution of all kinds from human activity, and climate change all contribute to undermining both the long-term stabilising effects of the ocean, and the socio-economic gains that it can yield, if used responsibly (OECD, 2016).

The identified major challenges that could potentially hinder the development of a sustainable ocean economy in the next 20 to 30 years should never be analysed in isolation to the 15 global challenges identified earlier in the chapter (see Section 3.3). Sustainable futures are ones in which the basic means of human livelihood become easier, human opportunities become richer, and nature's diversity is more sustained, and not only in the rich parts of the world but globally (OECD, 2016). In summarising the major challenges, Table 3.6 shows the challenges in relation to the 15 global challenges and the ocean service or sector that may be affected.

3.9.4 Disease events

Epidemics impact people’s health and livelihoods far beyond the direct effects of the outbreak in the sectors of the countries where the disease occurs. Health is fundamental to a prosperous productive society, whereas panic and illness can stifle production, consumption, recreation, travel and overall well-being (Marin, 2017; Adeola & Evans, 2018; Lawanson & Evans, 2019; Nwaogwugwu & Evans, 2019; Mbanda and Fourie, 2020). Health disasters such as the Ebola virus in West Africa, the Middle East Respiratory Syndrome (MERS) outbreak in the Republic of Korea, and the rise of COVID-19, not only have global health impacts been experienced but also wide-ranging socio-economic disruptions (Evans, 2020). During 2003 Severe Acute Respiratory Syndrome (SARS) epidemic, the global economy lost an estimated $40 billion (World Bank, 2018). The direct economic burden of the 2014 Ebola outbreak is estimated between $2.8 billion and $32.6 billion of lost gross domestic product, with the comprehensive economic and social costs factored in, the cost to the global economy was estimated at over $51 billion, with $18 billion in deaths from non-Ebola causes (Adeola & Evans, 2018; Lawanson & Evans, 2019). Huber, Finelli and Stevens (2018), Adeola and Evans (2018) and Lawanson and Evans (2019) argue that the impact of the outbreak of the SARS-CoV-2 spread from Asia to other parts of the world including Europe and the emergence of many SARS-CoV-2 cases in Italy and South Korea as two of the world's major economies, concerns have been raised regarding a global economic damage.

Table 3.6 summarises the major challenges that could potentially hinder the development of a sustainable ocean economy in the next 20 to 30years. Pollution and climate change were key for promoting healthy oceans as well as proper governance and coordinated efforts on combating illegal fishing and reducing new and re-emerging diseases.

Table 3.6: Summary of major ocean economy challenges and affected sectors

Major ocean economy challenge	**15 global challenges**	**Sectors affected**
1. Pollution	Reducing threat of new and re-emerging diseases and immune microorganisms	• Marine transport and manufacturing • Offshore oil and gas exploration • Fisheries and aquaculture • Small harbours • Coastal and marine tourism
	Meeting growing energy demands safely and efficiently	• Marine transport and manufacturing • Offshore oil and gas exploration • Fisheries and aquaculture • Small harbours • Coastal and marine tourism

Major ocean economy challenge	15 global challenges	Sectors affected
2. Illegal, Unreported and Unregulated Fishing	Balancing population growth and resources	• Marine transport and manufacturing • Offshore oil and gas exploration • Fisheries and aquaculture • Marine protection services and governance • Small harbours • Coastal and marine tourism
	Promoting ethical market economies in reducing inequality	• Marine transport and manufacturing • Offshore oil and gas exploration • Fisheries and aquaculture • Marine protection services and governance • Small harbours • Coastal and marine tourism
	Preventing transnational organised crime networks from becoming more powerful and sophisticated global enterprises	• Marine transport and manufacturing • Offshore oil and gas exploration • Fisheries and aquaculture • Marine protection services and governance • Small harbours • Coastal and marine tourism
3. Climate Change	Addressing global climate change and sustainable development	• Marine transport and manufacturing • Offshore oil and gas exploration • Fisheries and aquaculture • Marine protection services and governance • Small harbours • Coastal and marine tourism
	Sufficient clean water without conflict	• Marine transport and manufacturing • Offshore oil and gas exploration • Fisheries and aquaculture • Marine protection services and governance • Small harbours • Coastal and marine tourism

Major ocean economy challenge	15 global challenges	Sectors affected
	Accelerating scientific and technological breakthroughs and improved human conditions	• Marine transport and manufacturing • Offshore oil and gas exploration • Fisheries and aquaculture, • Marine protection services and governance • Small harbours • Coastal and marine tourism
4. Disease events	Reducing threat of new and re-emerging diseases and immune microorganisms	• Marine transport and manufacturing • Offshore oil and gas exploration • Fisheries and aquaculture • Marine protection services and governance • Small harbours • Coastal and marine tourism
	Balancing population growth and resources	• Marine transport and manufacturing • Offshore oil and gas exploration • Fisheries and aquaculture • Marine protection services and governance • Small harbours • Coastal and marine tourism
	Accelerating scientific and technological breakthroughs and improved human conditions	• Marine transport and manufacturing • Offshore oil and gas exploration • Fisheries and aquaculture • Marine protection services and governance • Small harbours • Coastal and marine tourism

Source: Researcher’s own construction.

As shown in Table 3.6, it is evident that the major ocean economy challenges and the associated global challenge impact all the six key ocean economy industries. It is necessary to explore innovative approaches as many changes are unfolding both in the ocean and in the science, research and innovation (STI) policy landscape (OECD, 2019) in mitigating against the identified challenges. A sustainable ocean economy cannot be addressed by any government or institution acting alone, nor can it be approached by focusing on one sector and not analysing the interrelated nature of the ocean environment. A sustainable ocean economy future requires collaborative action among governments, international organisations, corporations, universities, NGOs, and creative individuals. BRICS has stimulated an ongoing debate about its future roles and impact in the international system. Much of the debate takes shape around its politico-economic influences, its rise as a counter to the international status quo, and how it could reconfigure matters directing the international system are areas worth exploring specifically around key ocean industries identified in the various countries.

3.10 SUSTAINABLE OCEAN PRINCIPLES

The UN Global Compact has, in consultation with more than 300 stakeholders worldwide, developed the Sustainable Ocean Principles (United Nations, 2019), which builds on the SDGs, specifically SDG 14 and the nine targets as highlighted in the research IN Section 3.4.2. The purpose of the guidelines is to promote the well-being of the ocean for current and future generations, as well as to emphasise the shared responsibility of businesses to take necessary actions to secure a healthy and productive ocean (United Nations, 2019). The nine principles cover three areas, namely, i) ocean health and productivity; ii) governance and engagement and iii) data and transparency. Signatories, which South Africa is part of the 193 countries that are member states of the United Nations, confirm their endorsement of the principles, setting out a framework for responsible business practices across relevant sectors and geographies (United Nations, 2019). The principles build upon and supplement the overarching Ten Principles of the UN Global Compact, including the fundamental responsibilities in the areas of human rights, labour, environment and anti-corruption (United Nations, 2019). Companies should understand the broader environmental and social consequences of their activities especially those around key ocean economy industries. According to the United Nations (2019), countries and companies should ensure that material ocean-related risks and opportunities are integrated in corporate strategy, risk management and reporting. They should ascertain that the ensuing responsibilities are clearly defined within the organisation (United Nations, 2019).

The nine principles are summarised in the Table 3.7 and categorised in the three areas of ocean health and productivity, governance and engagement and data and transparency.

Table 3.7: Nine sustainable ocean principles

OCEAN HEALTH AND PRODUCTIVITY
Principle 1: Assess the short- and long-term impact of their activities on ocean health and incorporate such impacts into their strategy and policies.
Principle 2: Consider sustainable business opportunities that promote or contribute to restoring, protecting or maintaining ocean health and productivity and livelihoods dependent on the ocean.
Principle 3: Take action to prevent pollution affecting the ocean, reduce greenhouse gas emissions in their operations to prevent ocean warming and acidification, and work towards a circular economy.
Principle 4: Plan and manage their use of and impact on marine resources and space in a manner that ensures long-term sustainability and take precautionary measures where their activities may impact vulnerable marine and coastal areas and the communities that are dependent upon them.
GOVERNANCE AND ENGAGEMENT
Principle 5: Engage responsibly with relevant regulatory or enforcement bodies on ocean-related laws, regulations and other frameworks
Principle 6: Follow and support the development of standards and best practices that are recognised in the relevant sector or market contributing to a healthy and productive ocean and secure livelihoods.
Principle 7: Respect human-, labour- and indigenous people-rights in the company's ocean-related activities, including exercise appropriate due diligence in their supply-chain, consult and engage with relevant stakeholders and communities in a timely, transparent and inclusive manner, and address identified impacts.
DATA AND TRANSPARENCY
Principle 8: Where appropriate, share relevant scientific data to support research on and mapping of relevance to the ocean.
Principle 9: Be transparent about their ocean-related activities, impacts and dependencies in line with relevant reporting frameworks.

Source: Adapted from United Nations (2019).

The nine principles as highlighted in Table 3.7 and the three areas that they cover, namely, i) ocean health and productivity; ii) governance and engagement and iii) data and transparency are crucial for the future of South Africa's ocean economy and the global ocean economy space. With ocean health being a key pillar that drives and affords nations to enjoy the benefits that various ocean economy industries present, data that supports ocean economy development and good governance and engagement remain key for a sustainable ocean economy.

3.11 SUMMARY

In Chapter 3, the researcher presented the global ocean economy and analysed the 15 global challenges and their implications for the ocean economy. From the literature, as presented in this chapter, it is evident that a sustainable ocean economy is multidimensional in nature; and that the key factors and drivers of change in ocean economy industries range from environmental to socio-economic issues. The chapter also considered key major challenges identified in literature and it is important to once again emphasise that the challenges are transnational in nature and trans-institutional in solution. The ocean and its resources are increasingly recognised as indispensable for addressing the multiple challenges that the planet faces in the decades to come. By mid-century, enough food, jobs, energy, raw materials and economic growth will be required to sustain a likely population level of between 9 and 10 billion people (United Nations, 2016; OECD, 2019). The potential of the ocean to help meet those requirements is significant, but fully harnessing it will require substantial expansion of many ocean-based economic activities. This will prove challenging, because the ocean is already under stress from over-exploitation, pollution, declining biodiversity and climate change (Bakun, Field, Redondo-Rodriguez and Weeks, 2010). Indeed, ocean health is declining rapidly in many parts of the world, with dramatic socio-economic consequences. Dealing with these challenges calls for fresh thinking in many areas. Chapter 4 provides an overview of the South African ocean economy, with specific focus on or highlighting the six key sectors and the key drivers for change that shape the ocean economy. By identifying the drivers for change, the research attempts to identify megatrends in the ocean economy and determine the opportunities and limitations applicable to South Africa in its achievement of a desirable future state for the ocean economy toward 2060.

CHAPTER FOUR

AN ANALYSIS OF KEY OCEAN ECONOMY SECTORS, DRIVERS AND WILD CARDS FOR SOUTH AFRICA'S OCEAN ECONOMY

4.1 INTRODUCTION

Chapter 3 was key in presenting an overview of the ocean economy, the strategic role of the sector in economic development and the global agenda key for developing this sector. This chapter highlights the key sectors for the ocean economy in South Africa, and the contribution made by key stakeholders in the South African ocean economy. Through highlighting the key sectors in the South African ocean economy, the chapter further investigates the sustainability of operations in the ocean economy as per the identified six sectors in the Operation Phakisa strategy and how these are key for anticipating the future for South Africa's ocean economy. Chapter 4 also deepens the understanding of South Africa's ocean economy by identifying the key factors that had a significant impact on the future of ocean economy industries as highlighted under the Operation Phakisa strategy for South Africa (Department of Environmental Affairs, 2014). To achieve this, a Social, Technological, Economic, Environmental, Political, Legal and Ethical (STEEPLE) environmental scanning process of the ocean economy analysis was drawn upon. The environmental scanning analysis allowed the researcher to map the current situation within South Africa's ocean economy through an environmental scan, identify key trends and possible drivers as well as disruptions within the South African ocean economy. Finally, the chapter presents a futures triangle on the output of the environmental scan. The futures triangle is important in future studies and for accomplishing the desired research outcome as it briefly analyses historical factors and patterns that have created the current situation within South Africa's ocean economy.

4.1.1 An overview of South Africa's ocean economy

South Africa has a long maritime history, a coastline of 3924 kilometres and with access to an Exclusive Economic Zone (EEZ) of oceans that covers 1.54 million square kilometres (Potgieter, 2018). The EEZ means that South Africa has jurisdiction over a vast sea area totalling approximately 1.54 million square kilometres, which exceeds its total land territory of 1.2 million square kilometres and is the site of considerable ocean-based traffic and activity (Department of Environmental Affairs, 2016; Potgieter, 2018). An estimated 30 000 vessels sail through South African waters annually. The EEZ further grants South Africa the rights to develop marine resources contained therein. South Africa relies on eight major seaports spread along its coastline for trade, namely, Saldanha Bay, Cape Town and Mossel Bay are found in the Western Cape; Port Elizabeth, Ngqura and East London in the Eastern Cape and Durban and Richards Bay in KwaZulu-Natal. South African ports are some of the largest in Africa. Durban is Africa's busiest, handling over 87 million tonnes of cargo per year (Transnet, 2019).

South Africa has rich and productive coastal waters that currently employ around 316 000 people in the ocean economic sector and contribute millions of rand to the national economy each year (Hosking et al, 2014; Van Wyk, 2015; WWF-SA, 2016). The estimated total contribution of coastal resources (without regulatory services) to the South African economy is approximately R57 billion (WWF-SA, 2016). The direct economic benefits from coastal resources, including the marine fishing industry, port and harbour development and the attractive lifestyles, recreation and tourism opportunities offered by a coastal location, are estimated to be around 35% of South Africa's annual gross domestic product (GDP) (WWF-SA, 2016). Department of Environmental Affairs (2014) and Van Wyk (2015) indicate that 58% of South Africa's GDP is based on trade and 98% of South Africa's trade volume moves by ship, in addition, the country generates a significant 3.5% of the world's seaborne trade volume.

South Africa's coastal areas generate substantial capital through their ecosystem services including tourism, recreation and fishing (Hosking et al, 2014). Coastal areas generate over R10 billion per year from recreation and tourism alone. Coastal protection and flow regulation has been estimated at R3.5 billion per year (Hosking et al, 2014). These resources are also valuable to local people, for instance, estuaries generate nearly R65 million a year from subsistence harvesting and fishing. They also contribute R4.2 billion per annum to the South African economy. However, the development of estuaries and their catchments has come at a cost of about R700 million per annum in terms of lost fishery benefits as well as unknown costs to society from the overexploitation of resources and loss of biodiversity. While estuaries may be viewed as small environmental domains, the larger coastal system in many ways cannot survive without them.

The Department of Environment Forestry and Fisheries (DEFF, 2020a) recognises 22 commercial fisheries with revenue estimated to be ZAR 3million annually, which will likely increase over time. The squid industry is one of South Africa's most valuable fisheries generating R500 million in foreign revenue per annum. Although commercial fisheries are well-managed, and reliable catch and research data is collected annually, a number of fish species are being overfished and some stocks have collapsed. Half or 50% of South Africa's fish stocks are considered to be of concern with 22% considered heavily fished and 25% considered heavily depleted (DEFF, 2020b). The South African economy is characterised, on the one hand, as developed and able to compete with other countries in mining, manufacturing, agriculture and services. On the other hand, the country is characterised as a developing country, with challenges in infrastructure, economic inequality, high unemployment rate (a primary source of poverty and which could fuel social instability and violent strife against the government) (Central Intelligence Agency, 2017). If these issues are not resolved, South Africa will be moving into a competitive economic situation where nations will seek to solve the challenges of stagnant or regressive economic growth (UNEP, 2012). This implies that the ocean economy can play a role in mitigating against the challenges of infrastructure, economic inequality and high unemployment rate in South Africa.

4.2 ACHIEVING SUSTAINABLE DEVELOPMENT IN SOUTH AFRICA

The 2030 Agenda for Sustainable Development provides South Africa with a framework to identify and address the most urgent and complex of its development challenges. Solving these challenges by 2030 will require consolidating successes, learning from experience and fostering innovative new approaches. South Africa is committed to realising the 2030 Agenda for Sustainable Development, based on three principles, namely:

- *Collaboration:* The complexity of the challenges faced by middle-income countries across the globe require strong partnerships between the government, civil society, Chapter 9 institutions, trade unions, the private sector and academia. This will require building on South Africa's rich history of civil society and trade union activism, utilising its private sector's commitment to sustainable and inclusive growth, unlocking the potential of expertise in its academic institutions and making use of such as institutions, especially the South African Human Rights Commission (SAHRC), which can assist in adopting a rights-based approach in the implementation of SDGs and enhancing coherence across implementing, monitoring and reporting agencies.

- *Coherence:* The 2030 Agenda emphasises the integrated nature of development goals. South Africa is committed to improve coherence between policies. This includes improving vertical coherence between national, provincial and local levels as well as horizontal coherence between different sectors. South Africa is currently setting up a comprehensive development planning mechanism to improve coherence. More coherent ways of addressing its complex challenges will also allow South Africa to increase the efficiency with which policies are implemented.
- *Impact:* To improve the livelihood of South Africa's most vulnerable groups and individuals, the 2030 Agenda should be approached with a sense of urgency. Better collaboration and more coherence should lead to short-, medium- and long-term impact, particularly on the lives of those currently excluded from the benefits of economic growth.

The SDGs find expression within the NDP: Vision 2030. This finding emerged from a mapping exercise to assess the convergence between the NDP and SDGs in 2018, conducted by the DPME and UNDP. The exercise determined that there is a 74% convergence between the NDP and the SDGs. According to a survey by Pricewaterhouse Coopers (PwCb, 2018), 68% of South African companies are aware and directly incorporated SDGs in their strategies and reporting processes. While this indicates good progress for the country, ambitious transformational action involves creating great South Africa's baseline report on the SDGs, which was conducted in 2017 by Statistics South Africa and is being widely used as an exemplar of good practice. Notwithstanding this, effective implementation will still require strong commitment, better communication strategy, better domestication at local level and proper coordination of progress from various stakeholders as well awareness of and support for the 2030 Agenda across all of government and society.

4.2.1 Incorporating SDG 14 in South African policies and plans

In South Africa, at the highest overarching levels of the national legal framework, marine and coastal management encompasses broader environmental rights (Department of Environmental Affairs, 2016). These rights are enshrined in Section 24 of the Constitution of South Africa. Section 24 of the Constitution guarantees a healthy environment to all South Africans and mandates the State to ensure that this right is upheld, through legislative or other means. This constitutional mandate is directly linked to SDG 14 on (i) preventing pollution and ecological degradation, (ii) promoting conservation and (iii) securing ecologically sustainable development and use of natural resources while promoting justifiable economic and social development. The ecosystem protection (including marine and coastal ecosystems) is one of the guiding principles of the NDP. The plan acknowledges that the ocean environment is strongly interlinked with the process of climate change and broader issues of ecological degradation. It makes specific mention of ocean acidification and depleting fish stocks, demonstrating alignment to the SDG framework through target 14.3 (minimise and address the impacts of ocean acidification).

Other elements of South Africa's national planning environment that have provided strategic and operational capabilities to the country's sustainable development thinking are the National Framework for Sustainable Development (NFSD), the 2012-2014 National Strategy for Sustainable Development and Action Plan (NSSD). The strategic priority put forward by NSSD 1 around enhancing monitoring and reporting systems for improved environmental performance, shows that the South African government has recognised the importance of indicator evaluation (Montmasson-Clair, 2012). The NSSD also emphasises elements of SDG 14 in terms of the plan's priority to value, protect and enhance environmental assets and natural resources (including coastal and marine environments). However, a key challenge faced by the NSSD was assigning value to natural resources and ecosystems. The country will need to generate financial resources to support biodiversity conservation over the medium term (Republic of South Africa, 2014).

The oceans play a vital role in sustaining life, both in the sea and on land (Department of Environmental Affairs and Tourism, 2000; Hosking et al, 2014). Oceans provide key natural resources, including food, medicines, biofuels and other products. The oceans help with the breakdown and removal of waste and pollution, and coastal ecosystems act as buffers to reduce damage from storms (OECD, 2016; WWF, 2021). Maintaining healthy oceans supports climate change mitigation and adaptation efforts. The seaside also serves as a major attraction for tourism and recreation. Despite the data challenges that limit South Africa's ability to report formally on the majority of the SDG 14 targets, there is ongoing activity in the target thematic area that creates an enabling environment to support progress against this goal. The oceans and coasts are overseen by a comprehensive and progressive policy and legal framework, and there is momentum in several enabling programmes. The South African government has set out policy measure to preserve life under water, such as fishing regulations and also introduced the governance and marine protection services lab or sector under the Operation Phakisa initiative, which is key in promoting life, both in the sea and on land (Department of Environmental Affairs, 2014).

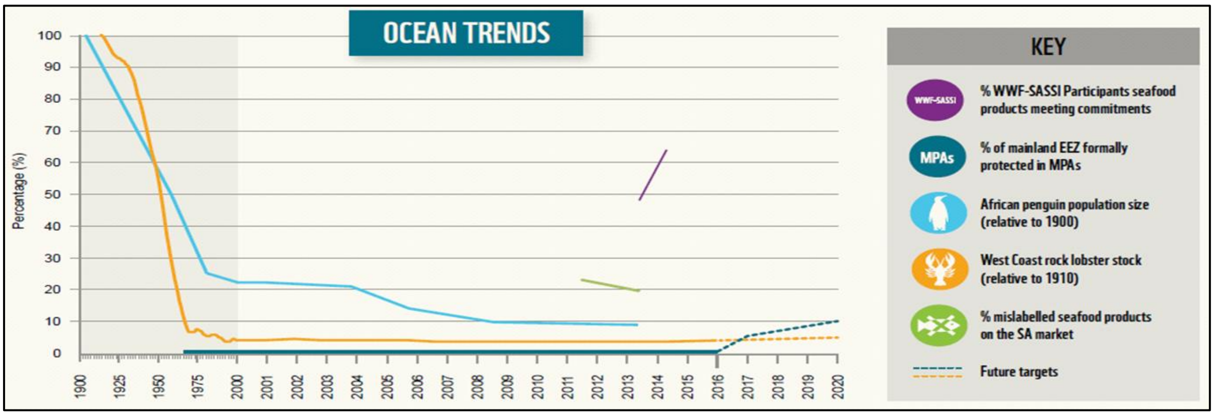
The Operation Phakisa initiative (with its focus on the ocean economy) originated from a state visit made by former President Zuma to Malaysia in August 2013 with a view to boost economic growth, job creation and foster infrastructural development within the South African ocean economy (Department of Environmental Affairs, 2014). During that visit, the President Zuma was introduced to the so-termed *Big Fast Results* methodology which had been applied in Malaysia in a highly-effective manner to achieve significant government and economic transformation within a short period of time in the areas of poverty, crime and unemployment. Engel et al (2018) consider that the Big Fast Methodology evolved as a response to the new public management approach developed in the United Kingdom and other Commonwealth countries during the 1980s. With the assistance of the Malaysian government, the Big Fast Results methodology was adapted to South Africa and restyled as Operation Phakisa (Akhalwaya, 2015).

Operation Phakisa launched by the government also aids the full implementation of SDG 14. To allow departments to respond more quickly and more proactively to harmful algae threats, the harmful algal blooms decision-support system was developed and released to public sector users and some users in the aquaculture industry. The system detects harmful algal blooms through marine remote sensing, making use of the detection of fluorescence and deriving chlorophyll in ocean water. SANSA contracted the French South African Institute of Technology at the Cape Peninsula University of Technology to develop, fabricate, test and launch a nano-satellite, ZACUBE-2, which is a precursor mission for a constellation of nine 3U CubeSats that will be used to monitor illegal fishing in South African oceans (Department of Environmental Affairs, 2016). The main payload of the mission is an automatic identification system/VHF data exchange system sensor. The ZACUBE-2 Mission is part of a grant award received from the DST. The ZACUBE-2 Mission will also have an imager that will be used for remote sensing purposes.

4.3 KEY SECTORS IN THE SOUTH AFRICAN OCEAN ECONOMY

South Africa is a unique maritime country. It has the third longest coastline of any African state and its location at the most southerly point of Africa means that it is bordered by two oceans, namely, the Atlantic Ocean lies to the west and the Indian Ocean to the east (Walker, 2018). This places South Africa at a strategic point astride one of the world's major shipping routes. The WWF-SA (2016) report summarises sectors that are key for sustainability, and although there has been a decline from 1975 up until 2014 for the African penguin population and the West coast rock lobster, targets from 2015 to 2020 show an increase. However, a report must still be compiled to provide the actual 2016 to 2020 statistics as shown in Figure 4.1. Though Figure 4.1 further shows that from 2012, there has been an increase in participating seafood products meeting sustainability commitments, the decrease in mislabelled seafood products in the South African market might be linked to this, showing positive trends for the ocean economy fish industry, which remains one of the key growth sectors in South Africa and globally (WWF-SA, 2016).

Figure 4.1: Ocean trends in South Africa from 1900 till 2020



Source: WWF-SA (2016), Oceans Facts and Futures Report.

Commercially, activities taking place within the South African ocean economy includes but is not limited to fishing, tourism, shipping, mining, renewable energy, agriculture and coastal geoengineering. However, exploitation and exploration of these natural resources, space and coastal developments undermine and disturb the ability of natural cycles to sustain their original form (Collie, Hiddink, van Kooten, Rijnsdorp, Kaiser, Jennings and Hilborn, 2017). South Africa's economy is also dependent on maritime infrastructure and space for trading with foreign countries (Department of Environmental Affairs, 2014; Potgieter, 2018). Economically, about 90 to 95% of South African foreign trades in volume, to the value of approximately $34 billion in 2007, were through the maritime space. Coastal provinces contribute the second highest Gross Domestic Product (GDP) after Gauteng, contributing about 38% to the annual GDP, highlighting the importance of the coast to the country's economy. In 2007, about 30% of the country's population lived within the 60 kilometres radius from the coast with approximately 80 people per square kilometre, making it one of the highest coastal population densities in Africa (Turpie & Wilson, 2011; Potgieter, 2018).

South Africa's Operation Phakisa holds that untapped marine resources stand to contribute greatly to the South African GDP by developing and refining matters on marine transport, manufacturing, offshore oil and gas exploration, aquaculture and marine protection services, as well as governance. In March 2014, the South African Cabinet approved the piloting of the Malaysian Big Fast Results (BFR) methodology, to be known in South Africa as Operation Phakisa (SAIMI, 2017). Operation Phakisa's delivery unit focuses on unlocking the economic potential of South Africa's oceans and is being coordinated and promoted by the Ocean Economy Secretariat at the SA

Government Department of Environmental Affairs (DEA), and is being led by the Department of Planning, Monitoring and Evaluation (DPME) (Funke et al, 2016).

The Operation Phakisa strategy identifies six *focuses* or *priority growth areas*, which are to be supported by two enablers, namely, (a) expansion of skills and capacity building under the responsibility of South Africa's International Maritime Institute, and (b) research, technology and innovation with the country's Department of Science and Technology as the key driver (Department of Environmental Affairs, 2016). The six priority growth areas, also referred to as sectors include (i) marine transport and manufacturing, (ii) offshore oil and gas exploration (iii) aquaculture, (iv) marine protection services and governance, (v) small harbours and (vi) coastal and marine tourism. In terms of the evolution of planning for Operation Phakisa, the four initial focus areas were maritime transport and manufacturing, offshore oil and gas exploration, aquaculture as well as marine protection services and governance. Small harbours as well as coastal and marine tourism were later additions (Potgieter, 2018).

South Africa's oceans are estimated to be able to contribute up to R177 billion to the GDP by 2033 (compared to R54 billion in 2010) and could lead to the creation of 22 000 new direct jobs by 2019 through the Operation Phakisa (Share et al, 2016). The South African International Maritime Institute (2017) indicates that Operation Phakisa focuses on six growth areas that are prioritised to contribute towards unlocking the economic potential of South Africa's oceans, based on their potential contribution to economic growth and job-creation. These growth areas include:

- Marine transport and manufacturing led by the Department of Transport
- Offshore oil and gas exploration led by the Department of Mineral
- Resources
- Aquaculture led by the Department of Agriculture, Forestry and Fisheries
- Marine protection services and ocean governance led by the
- Department of Environmental Affairs
- Small harbours development led by the Department of Public Works
- Coastal and marine tourism led by the Department of Tourism

In expanding on the six growth areas that are prioritised to contribute towards unlocking the economic potential of South Africa's oceans, Sections 4.3.1. to 4.3.6 highlight the six sectors and/or priority growth areas identified for South Africa's ocean economy.

4.3.1 Marine transport and manufacturing

About 90% of global trade in volume is believed to be transported through shipping, thus, it is important to develop plans that enable transport and manufacturing initiatives that conserve and protect maritime environment (UNCTAD, 2012; OECD, 2012). For developing countries, on a national basis, these percentages are typically higher. World seaborne trade grew by 4% in 2011, to 8.7 billion tonnes despite the global economic crisis, and container traffic is projected to triple by 2030 (OECD, 2012). The financial crisis, which began in 2008, has had a prolonged and adverse impact on the maritime sector with a great decline in some traditional forms of finance. Yet, the importance of maritime in moving goods and commodities around the globe persists (UK Department of Transport, 2019). This has allowed coastal countries to continue to position themselves in terms of facilities and capacities to cater for this growing trade and optimise their benefits.

The International Maritime Organisation (IMO) has set targets to reduce GHG emissions from international shipping by at least 50% by 2050 compared with 2008 (United Nations, 2020). Companies in the sector are also setting decarbonisation objectives for the operations and value chains. Zero-emission vessels and fuels need to be in operation as early as 2030 to meet the IMO's 2050 ambition. To achieve these objectives, there will need to be new ship designs, propulsion systems and alternative fuels that will be integrated into new ships (United Nations, 2020). This will provide challenges but also opportunities to shipyards. Shipyards also need to drive or at least adapt to the development of autonomous vessels. Shipyards are where new technology is implemented in practice and will require new management systems, new capabilities, new technology and new business models that ensure building, operation and maintenance of ships in a sustainable manner. In addition, shipyards and their value chain have a responsibility, to protect the environment, to respect human and labour rights, to be transparent and to report publicly.

4.3.1.1 Shipping

The ocean provides raw materials, energy, food, employment, a place to live and a place to relax. Shipping is just one of many stakeholders benefitting from the use of the ocean and this must not come at the expense of ocean and marine ecosystem health and productivity (United Nations, 2020). The environmental impacts of maritime activities are well known and many issues that affect shipping today and in the future are already regulated by the IMO, notably:

(i) Air emissions, including Sulfur oxide (SOx), Nitrogen Oxide (NOx) and Particulate Matter (PM)
(ii) Discharge of waste to sea (sewage, grey water, solid waste)
(iii) Transportation of dangerous goods and noxious liquid substances
(iv) Transportation of invasive species in ballast water and through hull-fouling
(v) Designation of Particularly Sensitive Sea Areas (PSSAs) and Areas to Be Avoided (ATBAs)
(vi) Operations in the polar regions through the Polar Code
(vii) Accidental spills of oil
(viii) Underwater noise

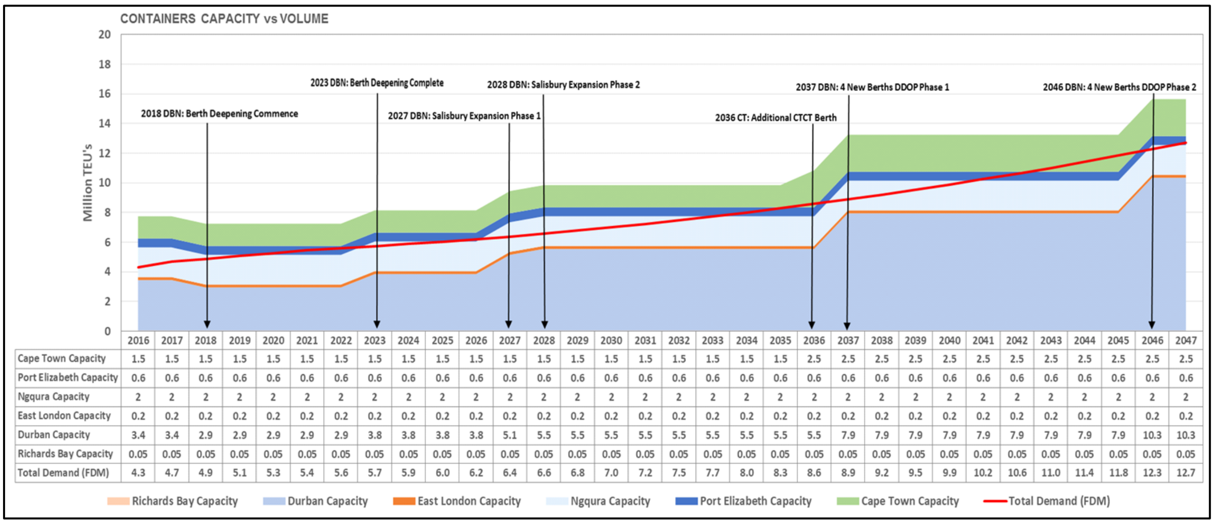
Even with these environmental impacts, other transport modes have reached the practical limits of scale, yet maritime container ships continue to respond to economic forces, having more than doubled in size within a generation (UK Department of Transport, 2019). The increasing demand for shipping services to support growing intra-regional and world trade as well as growing offshore activities has seen a growth within the shipbuilding and ship repairing industry across a number of regions globally. Ebarvia (2016) notes that internationally, a few shipyards in Europe and Asia have upgraded their capacity and expanded their business, while new ones have been built to meet the demand for merchant vessels. Technologies in shipping such as 3D printing, robotics, green energy, augmented and virtual reality are also important areas for consideration in an attempt to foresee what the future may hold for the shipping industry.

4.3.1.2 Port infrastructure and development

South Africa relies on eight major seaports spread along its coastline for trade, namely, Saldanha Bay, Cape Town and Mossel Bay are found in the Western Cape, Gqeberha (what was previously known as Port Elizabeth), Ngqura and East London in the Eastern Cape, and Durban and Richards Bay in KwaZulu-Natal. South African ports are some of the largest in Africa (Transnet, 2019). Durban is Africa's busiest, handling over 87 million tonnes of cargo per year (Walker, 2018). The marine transport and manufacturing focus, in the Operation Phakisa strategy, essentially is about maximising potential around South Africa's nine major ports and enhancing port infrastructure to unlock potential opportunities around the growth of cargo handling, sea and coastal shipping and supporting transport/logistic activities including storage and warehousing (Department of Environmental Affairs, 2016). Against this backdrop, a variety of initiatives are taking place including new port infrastructure (at Saldanha Bay, Richards Bay and East London) and improvement of ship repair facilities and dock expansion, which is occurring at several commercial ports (Rogerson & Rogerson, 2019).

The primary role of a port is to provide adequate safe and efficient facilities for maritime freight activities. The older South African ports are geographically positioned to service their immediate hinterlands, namely, Cape Town providing for the Western Cape, Port Elizabeth and East London serving the Eastern and Central Cape regions, with Durban serving KwaZulu Natal, Gauteng and more distant neighbouring states. In this role, they have developed as general cargo ports providing a wide range of services, with the more recent development of increasingly important container handling facilities (Transnet, 2019). The newer ports were developed primarily to provide for the handling of bulk cargoes with Saldanha Bay providing export facilities for iron ore from the northern Cape, Richards Bay handling exports from the coal mines, and Ngqura handling dry and liquid bulk cargoes (Transnet, 2016). The regional grouping of old and new ports has resulted in a complementary ports system that maximises on advantages of scale, avoids duplication, and provides a logical distribution of port facilities to meet the national need. Figure 4.2 illustrates the National Infrastructure Development Strategy, divided into the various ports in the country and the anticipated growth towards the year 2047.

Figure 4.2: National Container infrastructure development strategy



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Cape Town Capacity	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Port Elizabeth Capacity	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Ngqura Capacity	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
East London Capacity	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Durban Capacity	3.4	3.4	2.9	2.9	2.9	2.9	2.9	3.8	3.8	3.8	3.8	5.1	5.5	5.5	5.5	5.5
Richards Bay Capacity	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Total Demand (FDM)	4.3	4.7	4.9	5.1	5.3	5.4	5.6	5.7	5.9	6.0	6.2	6.4	6.6	6.8	7.0	7.2

	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
Cape Town Capacity	1.5	1.5	1.5	1.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Port Elizabeth Capacity	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Ngqura Capacity	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
East London Capacity	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Durban Capacity	5.5	5.5	5.5	5.5	5.5	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	10.3	10.3
Richards Bay Capacity	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Total Demand (FDM)	7.5	7.7	8.0	8.3	8.6	8.9	9.2	9.5	9.9	10.2	10.6	11.0	11.4	11.8	12.3	12.7

Source: Transnet (2019).

As shown in Figure 4.2, the major ports that contribute largely to South Africa's total container volumes are the ports of Durban, Cape Town and Ngqura. The projections show that leading up to the year 2047, the total demand volumes for the country will increase and this impacts positively on the future of the ocean economy leading up to 2060. South Africa has an enabling governance framework to allow for maritime activities to take place and this was seen with the birth of both Vuka Marine and MC5 Shipping during the first decades of the 21st century (Mabiletsa, 2016). If maritime activities are properly harnessed, South African shipping will have a meaningful participation in world shipping (Mabiletsa, 2016: Williams, 2019) and will yield the anticipated growth as shown in Figure 4.2. Although South Africa is not a shipping country, it would be expected that the shipping industry contributed incalculably to the GDP of the country. This is, especially after establishing that seaborne trade accounts for about 90% of products per volume leaving and entering the country. However, this is not the case as indicated in the Shipping Economic Study (Department of Transport, 2011). This is because South Africa has only four vessels on its shipping registry, therefore, shipping has no economic throughput (UNCTAD, 2018). Notably, cargo handling and other maritime services are classified under the transport sector with port operations regarded as industrial activities. Ship building has declined to an almost non-existent state with irregular and infrequent harbour crafts and trawlers saving the industry from extinction.

4.3.1.3 Transportation and regional trade

South Africa's ports and harbours are also important as neighbouring states, especially landlocked Southern African Development Community (SADC) countries who depend on its extensive and sophisticated maritime infrastructure to facilitate almost all their trade with the rest of the world (Programme for Infrastructure Development in Africa, 2011; African Development Bank, 2016a; Walker, 2018). South Africa's ability to offer ports and infrastructure for linking the Atlantic and Indian oceans, such as the Port of Ngqura, make it an important potential site for transhipment to other African countries and markets.

Each port has well-developed rail infrastructure providing rail connectivity to the hinterlands, and to adjacent regional ports. Rail infrastructure within the port limits is generally owned by TNPA and operated by TFR. This includes in-port rail lines, yards and terminals. The Sishen-Saldanha heavy haul line terminates at the iron ore export terminal at Saldanha Bay. The Port of Cape Town is linked to Gauteng by the Cape Corridor. This handles a range of general freight cargoes and containers (Transnet, 2019).

Gqeberha (what was previously known as Port Elizabeth) and Ngqura are similarly linked to the Gauteng hinterland by the Central Corridor, which also handles a range of general freight and containers. The export of manganese ore from Hotazel in the Northern Cape also uses this corridor. East London is connected to the corridor at de Aar. The Natal Corridor serves to connect the Port of Durban with Gauteng, with the North Coastline connecting Durban to Richards Bay. The Richards Bay Corridor is a heavy haul line used primarily for the export of coal. The port rail corridors meet in Gauteng, where a planned rail ring will separate freight trains from commuter traffic and allow for a seamless connectivity between corridors and to City Deep and other inland terminals, including, in the future, Sentrarand, which will service the Gauteng region. Cross-border rail corridors to Namibia, Botswana, Zimbabwe and Mozambique also connect to the Gauteng rail ring, ensuring that the ports are integrated into a comprehensive regional rail network (African Development Bank, 2016). The new Swazi rail link will increase capacity and provide flexibility for freight moving through both Richards Bay and Maputo. The ports are generally well served by and connected to the regional road infrastructure. The N2 links all the ports from Cape Town to

Richards Bay along the coastal route. The N1 from Gauteng to Cape Town and the N3 from Gauteng to Durban are the primary port road corridors. PE and Ngqura connect to the N1 via the N10, and East London via the N6. Planning is being undertaken with local, provincial and national road agencies to ensure alignment of port, rail and road planning.

In implementing the Operation Phakisa Strategy (2014), South Africa identified a few projects under the marine transport and manufacturing industries. The report that the Department of Environmental affairs (2020) provided to Parliament highlighted the following shipping milestones:

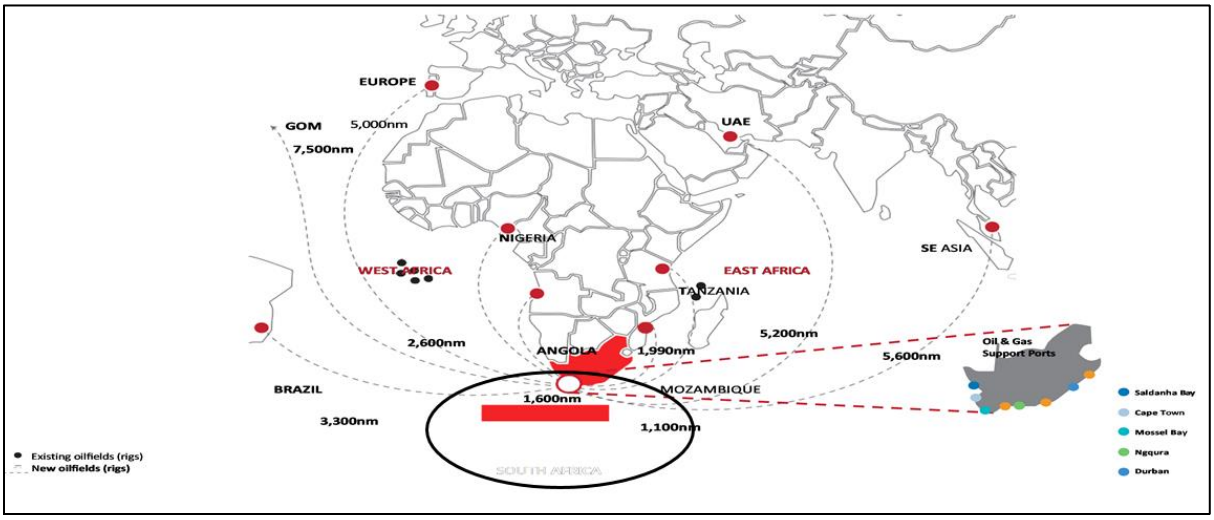
- Outer dry dock caisson in Durban was installed and refurbished, which means that more vessels can go for dry docking in the Port of Durban.
- Floating ship repair dock in Durban received an investment of R300 million, which means that more vessels can be repaired in the Port of Durban.
- In Port Elizabeth, the slipway and lead-in jetties were refurbished.
- New 90-tonne boat hoist in Gqeberha (what was previously known as Port Elizabeth) is probably the second of its kind in the country. This means that more of the fishing vessels, especially in the squid fishery, can now be hauled out of the water for annual inspection. Previously, only three of four could be done at a time, now 12 can be done.
- Burgan fuel storage facility is operational in Cape Town; it was a R660 million investment, creating 600 jobs in Cape Town.
- Offshore supply base in Saldanha Bay is part of the offshore oil and gas complex; work has already been completed.
- Sunrise Energy Liquid Petroleum Gas (LPG) facility in Saldanha Bay is operational.
- Cruise liner terminal in Cape Town is operational.
- Comprehensive Maritime Transport Policy exists.
- South Africa (DEA, 2020; SAMSA, 2020) has four vessels on the South African Ships Registry.
- State-of-the-art tugboats were built by a local shipyard in the Port of Durban.
- Offshore diamond mining vessels, which are now being used by De Beers on the West Coast, were built in the port of Cape Town. This demonstrates South

Africa's capability and capacity to build specialised vessels in South Africa with local labour and local procurement. Currently, the shipyard in Durban is building a specialised hydrographic vessel for the South African Navy.

4.3.2 Offshore oil and gas exploration

South Africa remains the preferred destination for repair, maintenance and upgrade of drilling ships, semi-submersibles and jack-up rigs for operations in African waters (Operation Phakisa, 2016). The country offers a compelling mix of world-class engineering, deep supply chains, and proximity to key drilling sites. In 2009, offshore fields accounted for 32% of worldwide crude oil production and this is projected to rise to 34% in 2025 (IEA, 2018). This production has increased, subsequently, as almost half the remaining recoverable conventional oil is estimated to be in offshore fields, quarter of that in deep water (IEA, 2018; Belleti and McBride, 2021). Deep water oil drilling is not new, but market pressures are making the exploration for and tapping of evermore remote reserves cost effective, bringing the most isolated areas under consideration. Methane hydrates, a potentially enormous source of hydrocarbons, are now also being explored and tapped from the seabed. Oil will remain the dominant energy source for many decades to come, but the Ocean offers enormous potential for the generation of renewable energy, namely, wind, wave, tidal, biomass, thermal conversion and salinity gradients. Of these, the offshore wind energy industry is the most developed of the ocean-based energy sources. Global installed capacity was only a little over 6 GW in 2012 but this is set to quadruple by 2014, and relatively conservative estimates suggest this could grow to 175 GW by 2035 (IEA, 2018). Figure 4.3 shows that South Africa as a country, is well positioned to service every oilfield in the continent and has the necessary skills and expertise.

Figure 4.3: South Africa's position to service the continent's oilfields



Source: Operation Phakisa (Department of Environmental Affairs, 2014).

South Africa has a powerful and stable emerging economy where the role of energy is critical to the success of achieving macroeconomic goals such as inflation targets and real economic growth (Department of Environmental Affairs, 2014). According to the United Nations Industrial Development Report (2018), cheap electricity and competitively priced transport fuels are critical for sustained industrial growth and, more especially, the surge in exports over the past ten years. Political stability, progressive economic policies and the managed liberalisation of core sectors of the economy have established the sound political economic base from which to stimulate economic growth (World Bank, 2018).

Although South Africa's economy is mainly supported by its vast mineral resources, the country imports about 130 million barrels of crude oil a year on average (Ramulifho, 2014). This means that there is high dependence on maritime space, shipping and transportation for the functioning of South Africa's economy. Its primary crude oil sources are Iran, Saudi Arabia, Nigeria and Angola (in order of dependency); highlighting the importance of international trade maritime space to provide for the country's development (UNCTAD, 2018). The country's refinery can only accommodate 250 million barrels annually (700 000 barrels a day) leading to a consumption of about 24.5 billion of fuel litres a year. Gas alone is reported to be critical for the country's economic stability (Ramulifho, 2014; UNCTAD, 2018). Much uncertainty surrounds the extent of South Africa's possible resources, with one government document citing a potential for around nine billion barrels of oil and around 60 trillion cubic feet (tcf) of offshore gas (Department of Environmental Affairs, 2016:20).

Overall, the goal is "to create an environment that promotes exploration while simultaneously maximising the benefits for South Africa" (Department of Environmental Affairs, 2016:20). The shaping of an appropriate enabling environment for exploration of oil and gas wells is projected both to increase the number of oil wells drilled while simultaneously maximising the country's value capture (Department of Environmental Affairs, 2016). As highlighted by the United Nations (2020), oil and gas activities have the potential to have negative and positive impacts on ocean health, during exploration and construction (for example, pipe laying, piling and trenching), production or decommissioning. The impact may come from the introduction of invasive species, planned emissions, noise and discharges or as a result of an incident. It is, therefore, necessary, prior to any work commencing, to understand the baseline conditions, assess the potential impacts and risks, and apply the mitigation hierarchy in the implementation of appropriate management actions.

In implementing the Operation Phakisa Strategy (Department of Environmental Affairs 2014), South Africa identified a few projects under the oil and gas industries and the report that Department of Environmental Affairs (2020) provided to parliament highlighted the various initiatives which needed partnership and investment to realise, including:

- South Africa has possible resources of about nine billion barrels of oil (about 40 years of fuel consumption) and about 60 trillion cubic feet (tcf) of gas offshore (equivalent to 11 billion barrels of oil), but uncertainty is high. The aspiration is to create an environment that promotes exploration while simultaneously maximising the benefits for South Africa.
- Drilling has to be carried out to determine the existence of reserves.
- Upstream Petroleum Development Bill remains a challenge, which needs to be fast-tracked as part of interventions by Department of Mineral Resources and Energy's (DMRE) post-COVID-19 response. According to the industry, legislation is currently not in place, which leaves legal and fiscal uncertainty.

- A total of five wells have been drilled from 2014 to date (one by private sector and four by government).
- An Incident Management Organisation was established, which is an emergency response. This was significant because the emergency response was considered for the first time in the offshore oil and gas industry, The Incident Management Organisation (IMO) was established to deal with emergency drills and joint exercises with the industry.
- Strategic Environmental Assessment (SEA) being conducted for the phased gas pipeline.
- Concept study for the Coega Liquefied Natural Gas (LNG) terminal (0.5 million metric tonnes per year (mtpa) phased gas pipeline network was completed. The company TOTAL became involved to mobilise a drilling rig for the Brulpadda Project. The cost of drilling was about $500 million. Recently, there was a second find, the Luiperd find, which is the second gas condensate.

4.3.3 Fisheries and aquaculture

The global community is challenged with meeting a growing demand for fish as an important source of protein, and other macro- and micro-nutrients, while simultaneously ensuring the sustainability of harvested stocks (United Nations, 2020). Sustainable fisheries and aquaculture could supply over six times more food than they do currently (364 million metric tons of animal protein). This represents more than two-thirds of the edible meat that the FAO estimates will be needed to feed the future global population.

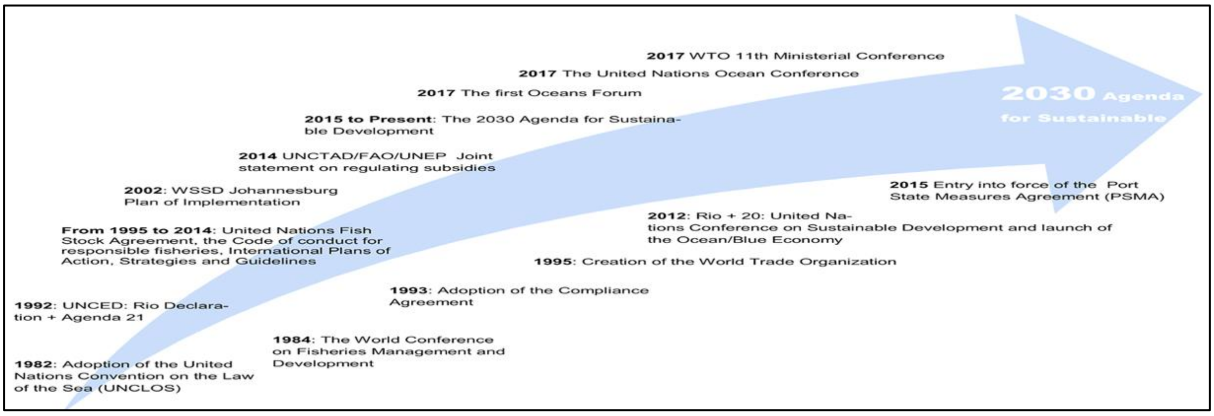
4.3.3.1 Fishing

The World Bank (2012) indicates that fisheries in Africa are characterised by many small-scale fisheries, contributing greatly to employment, with the bulk of fishery employment being in the post-harvest economic activities, which includes fish processing and marketing. Globally, 350 million jobs are linked to marine fisheries, with 90% of fishers living in developing countries (FAO, 2016). The value of fish traded by developing countries is estimated at US$ 25 billion, making it their largest single trade item (FAO, 2016; OECD, 2016; WEF, 2017). Global catch rose from four million tonnes in 1900, to 16.7 million tonnes in 1950, 62 million tonnes in 1980 and 86.7

million tonnes in 2000. However, this has stagnated subsequently (FAO, 2016). In 2009, marine capture production was 79 million tonnes. Overall catch risks declined with 75% of stocks fully-exploited or depleted. Although human activity has directly and markedly reduced ocean productivity, additional deficits may be due to climate change increasing ocean stratification and reducing nutrient mixing in the open seas. Global Ocean Observing System (GOOS) and LME assessments show significant warming trends from which model projections 2040-2060 forecast a steady decline in ocean productivity (FAO, 2016). The implementation of integrated, ecosystem-based approaches based on the best available science in a precautionary context, plus the removal of fishery subsidies that drive overexploitation offer the prospect of restoring key stocks and increasing catches. It is estimated that 50 US$ billion per annum is lost to overfishing and could be progressively recovered through stock restoration. The implementation of sound management measures brings the promise of increased sustainable catches, lower energy utilisation and costs, thereby securing livelihoods and enhancing food security.

By the late 1980s, it became clear that fisheries resources could no longer sustain rapid and often uncontrolled exploitation and development, and that new approaches to fisheries management, embracing conservation and environmental considerations were needed urgently (United Nations Conference on Trade and Development (UNCTAD), 2018). Figure 4.4 shows that fishing Plans of Action (POAs), resolutions and commitments for healthier oceans were made, all aimed at addressing the depleting fish resources. Concurrently, UNCTAD (2018) streamlined sustainability of living aquatic resources in its programmes on trade and development and partnered with FAO and other organisations to support and enable coastal developing countries, in particular, LDCs and SIDS, to achieve greater benefits from sustainable fish trading. Figure 4.4 shows the various UNCTAD's (2018) POAs from 1982 up to 2017, which demonstrated their commitment to healthier oceans and ensuring that the fishery industry provided more than just a source of protein and food.

Figure 4.4: Fishing Plans of Action (POAs), resolutions and commitments for healthier oceans



Source: United Nations Conference on Trade and Development (2018).

South Africa's commercial fisheries consist of 22 sectors with more than 2 900 rights holders and approximately 1 788 vessels (DAFF, 2012). Annual production was reported in 2012 as more than 600 000 tonnes with a value of R5.8 billion (DAFF, 2012). After South Africa's transition to a constitutional democracy in the 1990s, poor coastal fishing communities that had been marginalised under apartheid policies had expectations of increased access to marine resources. Although multiple reform and transformation measures have since been implemented, dwindling resources, increasing criminalisation and conflicts around rights allocation have created significant governance challenges. In 2012, DAFF's Policy for the Small-Scale Fisheries (SSF) sector was gazetted to improve co-management and redress the exclusion of traditional/artisanal fishers from the commercial fishing sector (DAFF, 2012). By 2016, more than 230 fishing communities had expressed interest in being recognised under this policy, which was in the process of being rolled out across the country with fishing right allocations anticipated in late 2016.

Further governance challenges surround the recreational fishing sector as there are no legal requirements to submit catch returns and the total catches by this sector are largely unknown (WWF-SA, 2016). In the State of the Environment Report, the Department of Environmental Affairs (2016) recognised 22 commercial fisheries with revenue estimated to be R3 million annually, which has likely increased over time. The squid industry is one of South Africa's most valuable fisheries generating R500 million in foreign revenue per annum (WWF-SA, 2016). Field, Attwood, Jarre, Sink, Atkinson and Petersen (2013) found that although commercial fisheries were well-managed, catch reliably and research data was collected annually, a number of fish species were being overfished and some stocks had collapsed. Fifty (50%) of South Africa's fish stocks are considered to be of concern, with 22% considered heavily fished and 25% considered heavily depleted (WWF-SA, 2016). Aside from over-exploitation of resources, fisheries also have bycatch (including dolphins and turtles). However, the fishery industry provides more than just a source of protein and food. It has also generated many resource-based oceans economic activities, such as mariculture, seafood processing and marine biotechnology (Field et al, 2013; FAO, 2016).

4.3.3.2 Aquaculture

A promising route for future expansion in the production of marine food is open-ocean aquaculture. The OECD (2019) cites that open-ocean aquaculture appears to offer numerous advantages compared to coastal seafood farming. These include fewer spatial constraints, less environmental impact, lower risk of conflicts with other ocean users, and fewer problems with disease (Béné, Hersoug, and Allison, 2010; Adeleke, Robertson-Andersson, Moodley and Taylor, 2020). However, very few large-scale open-ocean farms are currently in operation, not least because they face a host of challenges, namely, designing structures that can withstand the harsh conditions of the open ocean, access to the facility for monitoring, harvesting and maintenance purposes, communications and safety of personnel (OECD, 2019).

Rising from a slow start, aquaculture production in Africa is poised for sustained growth over the next two decades (WWF-SA, 2016). An emerging industry, according to DAFF (2015), is the commercial aquaculture industry that is relatively new in comparison to commercial wild-capture fisheries. However, it is growing steadily with a total production of 4 802 tonnes in 2013, which represents an increase of 18% compared to the previous year. In 2012, the aquaculture industry contributed only approximately 0.8% to South Africa's fish production (WWF-SA, 2016). Although there are operational aquaculture farms in all of South Africa's provinces, not all farms produce on a commercially viable scale. In 2013, 2 831 people were employed by the aquaculture sector, with the majority employed in the Western Cape (65%) (DAFF, 2015). The intersection of market opportunities, economic factors and environmental conditions positions the continent as arguably the great frontier for aquaculture development, which was set to be a focal point of discussions at the World Aquaculture

Society meeting in Cape Town, South Africa, in June 2017. The South African market is increasingly demanding environmentally-sustainable seafood, which has created a competitive advantage for aquaculture products that are sustainably produced (Adeleke et al, 2020; WWF-SA, 2021).

The abalone and trout sectors remained the most valuable, contributing just over 90% of the total value of the industry, with abalone contributing 77%, trout 10% and mussel 6% (Adeleke et al, 2020; WWF-SA, 2021). The total sales value across the aquaculture sector in 2018 was approximately R1 billion, excluding additional value generated through leisure and tourism, such as trout farming. The Responsible Fisheries Alliance had also undertaken a study on endangered, threatened and protected species landed in five major commercial fisheries (Adeleke et al 2020). The main challenges were onerous local regulations, the impact of COVID-19, access to water and unsuitable climatic conditions, the absence of economies of scale, a reliance on exports and a highly-competitive international market environment. The WWF- SA (2021) reported on its marine programme focus areas, and listed a number of successes, such as launching a recreational guide on responsible fishing, a "Working on Fishery" improvement project for five fisheries to drive sustainability, and improved collaboration within the fishing sector as evidenced in addressing key issues such as seabed mining around the coastline, and declining African penguin populations.

Challenges included lobbying for policy and management changes, advocating for decision-making based on scientific evidence, and reinstating the Offshore Resource Observer Programme. General concerns included key fisheries being in decline, inadequate governmental capacity and support for the small-scale fishing sector, no dedicated management of the recreational fishing sector, impacts of climate change, archaic fisheries' data systems, lack of fishery management plans, weak enforcement, inadequate monitoring, and how the short duration of fishing rights did not promote stewardship or development of fisheries in South Africa (Adeleke et al, 2020; WWF-SA, 2021).

The WWF-SA (2021) Sustainable Seafood Initiative (SASSI) has been highly-successful in changing consumer behaviour and seafood supply chain procurement through awareness campaigns and easily accessible information for consumers on the sustainability status of fish species. Launched in 2004, SASSI has significantly changed the way that South African suppliers, restaurants and consumers view fish, generating widespread buy-in and shifting demand from over-exploited fisheries to more sustainable species (Béné, Macfadyen and Allison, 2007). SASSI works across the entire supply chain, with producers to improve harvesting and production methods and with retailers on setting and measuring sustainability goals. The most significant success from the SASSI initiative has been in raising public awareness, stimulating consumer demand for sustainable fish and creating a ripple effect back down the supply chain. According to the OECD (2016) and WWF-SA (2016), aquaculture is deemed to be a viable solution for meeting future food demands, and because of operating in common waters, the sector has a strong focus on social license to operate. This includes responsible and transparent operations to demonstrate its environmental and social performance. The farmed seafood value chain is complex and involves many levels, thus, it is important to ensure transparency of operations and contracting (WWF-SA, 2016). Often, the industry operations are under local, national and international legislation. Therefore, it is necessary to understand the complexity of the legal landscape.

In implementing the Operation Phakisa Strategy (Department of Environmental Affairs, 2014), South Africa identified a few projects under the Fisheries and Aquaculture industry and the report that Department of Environmental Affairs (2020) provided to parliament highlighted the various initiatives which needed consultation and an integrated approach from government, business and societies to realise, including:

- Aquaculture Development Bill
    - Further stakeholder engagement. Some sectors want self-regulation.

- Strategic environmental assessment completed. For anyone who wants to embark on aquaculture activity, a person only has to do a basic assessment (OECD, 2010; Fundingsland and Hanusch, 2012).

- Inter-Departmental Authorisations Committee established. This department considers the administration and business processes at all of the departments that are involved when a person applies to perform an aquaculture activity. The business processes of all these departments previously took about 890 days. This was reduced to 240 days. The department is working on how it can shorten the legislative timeframes.

- Import/Export working group established to ensure diversification of markets as well as protection of the local sector, trade regulations and exports. With COVID-19, there was a significant impact when the world came to a standstill, ports were closed and there was no offset for the aquaculture products.

4.3.4 Marine protection services and ocean governance

Currently, Schafer, Heywood, Jacoby and Waitz, (2009) described ocean users as being in a state of "use without coordination". Douvere and Ehler (2009) postulated that there is a need for a common language amongst ocean space users. Furthermore, Ramulifho (2014) indicated that the current state can be described through the concept of *"Laissez-faire, laissez-aller"*. This means that the state of oceans is in an economic juncture where transactions between private entities are free from government restrictions with very minimal regulations to protect it. South Africa has found a legislative gap in ocean governance (Department of Environmental Affairs, 2014). Various user groups that did not previously infringe on one another now find themselves using similar areas of the marine environment. Sectorial management of marine resource use creates pressures and opportunities for human usage when addressed in a silo or separately and can have unintended consequences with respect to other sectorial uses and the marine environment itself. Potgieter (2018) further cite that the lack of comprehensive surveys of existing international and domestic legal instruments have an impact on ocean-related activities. Fragmentation, overlaps, conflicts and gaps exit between these instruments and have a negative impact on ocean governance and management and a sustainable and safe ocean economy in the future.

The roles of society, science and government in the Operation Phakisa ocean governance is very important (Findlay, 2017; Odeku, 2020). To demonstrate that the government is keen and eager to unlock the potential of the ocean resources, the government opened the Ocean economy Lab, under the auspices of the Department of Environmental Affairs, which began on 8 July 2014 in Durban and was concluded on 15 August 2014. The Ocean economy Lab was attended by over 180 delegates from national and provincial government departments, the private sector, civil society, labour and academia who all convened for the purposes of forging a way forward on how to unlock and utilise the ocean resources for economic growth in South Africa and for the promotion of sustainable development for all citizens. The main focus of the Ocean economy Lab was on unlocking the economic potential of South Africa's oceans to grow the economy and derive maximum value for the country. This would foster inclusive economic growth, which would contribute to the gross domestic product (GDP), create jobs, tackle and reduce unemployment and poverty as well as provide food for the people.

In implementing the Operation Phakisa Strategy (2014), South Africa identified a few projects under the Marine Protection Services and Ocean Governance, and the report that Department of Environmental affairs (2020) provided to parliament highlighted various initiatives which needed consultation and an integrated approach from government, academia and societies to realise including:

- MSP Act (April 2019). This was a first for the country and, compared to the rest of the world, South Africa was the at forefront in putting in place this piece of legislation that dealt with user conflict and made sure that South Africa better planned the activities within the ocean space. Sector Plans are now being developed.

- Twenty marine protected areas (MPAs) gazetted:
    - Covering approximately five% of South Africa's Exclusive Economic Zone (EEZ), critical habitats and ecosystems.

- Oceans & Coastal Information System (OCIMS) implemented:
  - Vessel tracking. South Africa is able to track very accurately vessels entering its EEZ. By the speed of the vessel, it is possible to discern if the vessel is travelling through South Africa's waters or trawling.
  - Harmful algal blooms. This is a natural phenomenon on the West Coast which has massive blooms of microscopic organisms known as dinoflagellates. These consume all of the oxygen in the water, which becomes oxygen-depleted. It had a huge effect on aquaculture farms, as well as West Coast Rock Lobster (for example, lobster walk-outs) and fish that become oxygen starved. With this tool, it is possible toc detect very early a reduction in oxygen levels in the waters on the West Coast. The department can then work with its colleagues in the fisheries branch and with industry to resolve oxygen level depletion.

- Water Quality Programme implemented. This implementation has been done along the coast. It is also important for the aquaculture industry and for health. The main national pollution laboratory is housed at the Walter Sisulu University in Umtata.

- Integrated and Coordinated Enforcement Programme implemented. This brings all the enforcement agents together to work together so that the department has a more integrated and coordinated programme in all coastal provinces.

4.3.5 Small harbours development

Small harbours, which run along the coastal water-land border interface in support primarily of the near-shore and offshore industries of fishing, aquaculture and other maritime economic activities have deteriorated to a state of near collapse (Odeku, 2020). This is a result of a lack of maintenance, safety and security measures, as well as investment thereby denying the offshore industries the much-needed launching. This impacts on the landing, processing and service site, which connects fishing, aquaculture farm as well as other maritime economic activities (Department of Transport, 2018).

Currently, South Africa has 12 proclaimed fishing harbours within the Western Cape as well as about 55 un-proclaimed harbours along the Northern Cape, Eastern Cape and KwaZulu Natal coasts. No new public harbours have been built since the 1950s (Department of Public Works, 2019, Odeku, 2020).

The first Operation Phakisa Small Harbours Development Lab took place in November 2018 and was well attended by various spheres of government, civil society, academia and business. The programme was divided into four weeks with the structured programme including Problem analysis, Initiative design, Implementation plans (3-feet detailed plans) and Costing and funding. According to the Department of Public Works (2018), the Lab had four work streams, namely:

- New small harbour established and development of coastal properties
- Redevelopment and maintenance of existing small harbours
- Socio-economic impact creation (job creation, skills development and enterprise development)
- Institutional arrangements (governance and operational management)

Small harbours are a maritime transport infrastructure identified as a key sector to drive government strategic objectives of radically-transforming society particularly on aspects relating to the participation of the historically-disadvantaged communities in the maritime domain including women and youth. Small harbours infrastructure development has always been the competency of the Department of Public Works and, as a result, in 2019, R402 million for the scope of work across of all 12 harbours was allocated, which includes removal of sunken vessels, dredging, slipway repairs and upgrades, shore crane replacements, security installations and apparatus as well as civil and electrical infrastructure repairs.

In implementing the Operation Phakisa Strategy (2014), South Africa identified a few projects under the Small Harbour industry and the report that Department of Environmental Affairs (2020) provided to parliament highlighted various initiatives which needed consultation and an integrated approach from government, business and societies to realise, including:

- Completing the Small Harbour Development Framework. All the proclaimed harbours are in the Western Cape. Cabinet decided that the department should also prioritise the establishment of small harbours in the Northern Cape. The department was potentially considering Port Nolloth, in Northern Cape, Port Edward/Hibberdene in KwaZulu-Natal, and Port St Johns in the Eastern Cape.
- Commencing an economic research and feasibility study for priority small harbours development in Northern Cape, KwaZulu-Natal and Eastern Cape provinces. This would determine what should be put in place, for example, whether a small harbour or a marina would work best in a particular area, and then working with the local authorities and communities to determine this.
- Maintaining harbour infrastructure: Implementing the Repair and Maintenance Programme, which would include removing 29 sunken vessels and completing dredging at Gordons Bay, Hout Bay, Stillbaai, Struisbaai and Gansbaai**.**

4.3.6 Coastal and marine tourism

Whereas tourism plays an important strategic role in promoting and strengthening international relations, it also contributes towards economic development of the country. As a result, proper investment schemes should be put in place to leverage sustainability of the sector as per the goals set in the NDP 2030 visions. International tourist arrivals increased from 4.5 million to more than 10 million between 1995 and 2017 and were accompanied by a tripling of employment directly related to tourism (OECD, 2020). In 2009, the tourism sector contributed about 8% of GDP and the Department of Tourism (2017) designated plans and resources to up the GDP contribution to 20% by 2020 as alluded in the National Tourism Strategy. Maritime tourism is, however, not given enough attention in the strategy. This indicates that there is still a lack of awareness towards opportunities and potentials that the maritime domain possesses in driving the country's development forward. There are opportunities for activities such as eco-maritime tourism (for example, shark cage diving, whale watching, sardine run, coral reef viewing) as well as boating, yachting, cruising, ferrying and recreational sports (for example, sailing, swimming and diving) and leisure. This compliment a very rich and complex seascape along the South African coastline, which provides opportunities to take advantage of in soliciting a thriving ocean economy.

Five cross-cutting enabling initiatives were identified to unlock the opportunities in South Africa's coastal tourism economy (Department of Tourism, 2017). These relate to marketing, safety and security, a review of regulations and permits, the enhancement of skills for transformation as well as for building entrepreneurship in coastal areas, and sustainability planning in terms of improved data repository with socio-economic and environmental information to guide spatial planning (Dwyer, 2018). Four further planned sets of initiatives were announced. First, is to identify and elevate events/festivals that would attract both domestic and international visitors, especially in the off-peak season. Second, is to promote a set of tourism routes along coastal areas to market together certain attractions and a variety of experiences (Myles, 2016). Third, is to tackle the challenges of infrastructural issues and shortcomings that constrain the growth of coastal and marine tourism particularly in non-metropolitan spaces. Last, is to seek to market coastal attractions that currently are not well known albeit are considered to offer future potential as tourism products (Department of Tourism, 2017). During 2017, Cabinet approved the Coastal and Marine Tourism Implementation Plan. The plan initially identified for implementation in 2018 till 2020, never fully realised its key objective of strengthening the linkages of tourism with other areas of Operation Phakisa (Department of Tourism, 2017 and promote coastal tourism within the greater country of South Africa.

It is significant that the country's tourism policy historically has accorded little attention to coastal and marine tourism (Dwyer, 2018; Rogerson & Rogerson, 2019). This oversight has prompted certain observers to speak of coastal and marine tourism development as a missed opportunity for the tourism economy (Dwyer, 2018). Despite having the assets of a number of spectacular beaches, South Africa has not developed the type of mass sea-sun-and-sand international tourism resorts that is represented, for example, by Cancun in Mexico or Sharm El Sheikh in Egypt (Dwyer, 2018). The major current development benefits of coastal and marine tourism accrue to the leading city tourism destinations of Cape Town and Durban with well-developed infrastructures (Rogerson & Rogerson, 2014 cited in Dwyer, 2018). It is argued that other coastal areas have not benefited as much because of lack of basic and tourism infrastructure. The emerging focus area around coastal and marine tourism is geared to improvement of coastal infrastructure for tourism and also to spread the benefits away from the existing traditional (*business as usual*) coastal tourism hubs (Department of Environmental Affairs, 2016).

Looking at the Tourism sector in 2021, the OECD (2020) highlighted that the recent COVID-19 pandemic and resulting containment measures have triggered an unprecedented crisis in the tourism sector. Still, the sector offers significant opportunities for an economy with weak growth and high unemployment. Streamlining and implementing electronic visa services for international tourists could increase South Africa's international openness. Reduction of red tape could strengthen the integration of the tourism sector into local value chains and amplify the impact of tourism on the domestic economy. For tourism to translate into inclusive and sustainable growth, the benefits must spread geographically. Necessary transport and accommodation infrastructure is needed to connect tourists to places. South Africa's tourism competitiveness can be improved through several interventions. First, greater budgetary support for tourism agencies is required and measures should be introduced to protect their budgets from the negative impact on currency fluctuation given its impact on marketing in foreign destinations. While a depreciating currency opens up new international market segments, budgetary support to tourism agencies is required to pursue these opportunities. The current budget of South African Tourism compares poorly with the tourism budgets of competitor nations. South Africa is ranked 130th out of 136 countries for the scale of budgetary support for travel and tourism (World Economic Forum 2017).

In implementing the Operation Phakisa Strategy (2014), South Africa identified a few projects under the Coastal and Marine Tourism industry and the report that Department of Environmental affairs (2020) provided to parliament highlighted various initiatives, which needed consultation and an integrated approach from government, business and societies to realise, including:

- Establishing events and routes as there are six key coastal marine tourism nodes, from Umkhanyakude in KwaZulu-Natal to the West Coast. The Department of Tourism (DOT) is looking at the development of specific routes and projects that could be implemented in an area, as well as the connectivity of the coast to the hinterland.

- Developing beach precincts and enhancing (infrastructure) and tourism safety
- Providing regulations and permits that promote marine tourism
- Conducting data collection and research on coastal and marine tourism initiative and innovations that promote economic growth and local areas.
- Developing maritime tourism, especially when it comes to nature-based tourism, or tourism that depends on natural resources such as boat-based whale watching, Great White shark cage diving and swimming with dolphins
- Developing skills that promote integrated and sustainable marine tourism
- Implementing a target market strategy, which needs to be communicated and implemented across all coastal and marine tourism role-players

Table 4.1 summarises the six key sectors in the South African ocean economy and the various subsectors that have been developed in growing and promoting a sustainable ocean economy.

Table 4.1: Key sectors in the South African ocean economy

Sector	Sub-sector
Marine transport and manufacturing	• Shipping • Port infrastructure and development • Transportation and regional trade
Offshore oil and gas exploration	• Offshore oil exploration • Offshore gas exploration
Fisheries and aquaculture	• Fishing • Aquaculture
Marine protection services and ocean governance	• Marine protected areas • Maritime regulatory • Naval defence
Small harbours development	• Marine coastal services • Transport • Maritime logistics
Coastal and marine tourism	• Boating and cruising • Sport and recreation • Leisure

Source: Researcher's own construction, adopted from Operation Phakisa (2014).

4.4 KEY POLICIES AND FRAMEWORKS SUPPORTING THE FUTURE OF SOUTH AFRICA'S OCEAN ECONOMY

The United Nations has proclaimed a decade of marine sciences for sustainable development (2021-2030) to develop a common framework that will enable the ocean sciences to fully assist countries in achieving the goal of sustainable development. One of the objectives is to achieve the integration of observations and data sharing, including the use of satellites, fixed and mobile observation platforms, and shipboard observation platforms (IOC-UNESCO, 2017). Ocean-observing systems will become a major asset in this task and it is incumbent on the marine scientific community to adopt an ethical approach in its research and the prompt communication of the research findings to the global community as well as use of the research to inform ocean economy policies and strategies.

For the purposes of the development of South Africa's ocean management policy, Government has been mindful of its constitutional, international law objectives and domestic responsibilities. South Africa has embraced sustainable development and integrated planning when pursuing ocean environmental integrity. According to the Department of Environmental Affairs, 2016), South Africa's ocean policy, therefore, takes cognisance of the following responsibilities in the marine area under its national jurisdiction, namely, the implementation of measures:

- To address the sustainable use of resources
- To address the maintenance of biological diversity
- To undertake research and monitoring
- To integrate management of its ocean environment by pursuing coordinated sectoral development while adopting a precautionary approach
- To respect international marine usage rules and to encourage research and monitoring of the High Seas.

4.4.1 National Environmental Management Act (Act 68 of 2008)

NEMA (2008) also confirms the importance of embracing sustainable development and integrated planning when pursuing ocean economy activities. For NEMA (2008), this is particularly so where ecosystem components overlap areas of national jurisdiction and the high seas, namely, and include implementation of measures:

- To address pollution of the ocean environment from both land and sea-based sources
- To ensure international and regional cooperation in future studies in respect of marine management
- To co-ordinate and harmonise policies, legislation and actions relating to the environment at an intergovernmental level
- To realise that global and international responsibilities relating to the marine environment must be discharged in the national interest

The Green Paper on the South African Policy on Ocean Environmental Management (2012) also confirms that ecosystem degradation, climate change and the identification of economic development opportunities have triggered a fundamental shift in international ocean management strategies in recent years. Sovereign states are increasingly moving towards coordinated or integrated management approaches premised on the regulation of all sectoral activities within their marine environment. This approach is based on the relationship between the totality or combined impact of human resource usage and its associated cumulative impacts on the marine environment. The implementation of an ecosystem-based ocean management approach will enhance South Africa's ability to manage and effectively respond to existing ecosystem degradation and improve and encourage the sustainable use of national and transboundary shared resources.

In the absence of a published comprehensive ocean economy development plan, or an integrated maritime strategy, South African maritime policies must instead be discerned through critically reviewing an assortment of policy frameworks (Blaine, Sinovich and Navy, 2015). Firstly, multi-departmental government documents such as the National Planning Commission’s (NPC) National Development Plan 2030: Our Future - Make it Work and the reports of the Operation Phakisa Ocean Economy initiative. Secondly, departmental performance appraisals and work plans of key stakeholders (National Planning Commission, 2011). Thirdly, key strategic documents such as the South African Navy's 2006 Doctrine, the Department of International Relations and Cooperation's (DIRCO) White Paper on South African Foreign Policy, the Department of Defence's (DOD) 2015 South African Defence Review and the Department of Transport's (DOT) 2017 Comprehensive Maritime Transport Policy (CMTP).

4.4.2 Integrated Coastal Management Act

The Integrated Coastal Management Act (Act No. 24 of 2008) (ICM Act) was established to promote an integrated coastal management approach and is informed by the national policy embodied in the White Paper for Sustainable Coastal Development in South Africa, adopted by cabinet in 2000.The benefits derived from the South African coast range from sustainable development opportunities to the preservation of ecosystems providing goods and services such as tourism and seafood (Béné et al 2007; Myles, 2016). The ICM Act is a major step forward in managing the South African coast and the first law of its kind in South Africa that promotes co-ordinated and integrated management and sustainable use of the country's coastal resources. It represents a fundamental shift in thinking towards the shared and vested use of these resources by all South African citizens. The ICM Act also aims to provide equitable access to South Africa's rich and diverse coastline and the use of its resources in a manner that is ecologically, socially and economically sustainable. The Act is a Specific Environmental Management Act (SEMA) under the umbrella of the National Environmental Management Act (Act no. 62 of 2008).

4.4.3 Operation Phakisa

Operation Phakisa is a replica of the Big Fast Results Methodology that was first designed and successfully applied by the Malaysian government in the delivery of its economic transformation programme and, as such, was fully-embraced and adopted by South Africa. The operation mainly focuses on unlocking the economic potential of South Africa's oceans, considering that for there to be a world-wide long-term development, this can no longer be based on land resources only and should also include the coast and the ocean resources. As a result, Operation Phakisa

(Department of Environmental Affairs, 2014, Odeku, 2020) commenced with operational work after the October 2014 launch by the government of South Africa. Overall progress to date for directly funded ocean economy projects impacts includes investments unlocked by the South African government amounting to approximately R29.4 billion in the ocean economy and over 7 093 jobs have been created in the various sectors. Figure 4.5 illustrates the short-, medium- and long-term goals of Operation Phakisa.

Figure 4.5: Operation Phakisa short-, medium- and long-term goals

	SHORT TERM 2016	MEDIUM TERM 2019	LONG TERM 2033
Jobs	26 000 jobs cumulative	77 100 jobs	1 million jobs
Economic growth	GDP contribution of R7.5 bn	GDP contribution of R32 bn	GDP contribution of R129-R177bn
Transformation indicator	•Monitoring of Maritime BEE Charter and application of BEE Codes in National Ports Act. (min level 4 BEE and focus on Ownership and Operation). •15% transformation (Aquaculture). •Opportunities for SMME's.	•Monitoring of Maritime BEE Charter and application of BEE Codes in National Ports Act. (min level 4 BEE and focus on Ownership and Operation). •26% transformation (Aquaculture). •Opportunities for SMME's.	•Monitoring of Maritime BEE Charter and application of BEE Codes in National Ports Act. (min level 4 BEE and focus on Ownership and Operation). •50% transformation (Aquaculture). •Opportunities for SMME's.

Source: Department of Environmental Affairs (2014).

As introduced in Chapter 1 (see Section 1.1 and 1.2) and as shown in Figure 4.5, the overall focus of Operation Phakisa is to promote economic growth and job creation. The coastal environment and ports have always been at the forefront of the ocean economic activities and are catalysts for economic growth through the trade of manufactured goods, commodities and raw materials. Foods sourced from the ocean are a source of protein, and many people rely on them on a daily basis. But for these ocean food sources to thrive, environmental sustainability is required, which means that the ocean has to be protected from pollutants and other hazardous substances. Therefore, it is imperative to intensify the development of the South African ocean economy by implementing Operation Phakisa.

4.4.4 Marine spatial planning

One of the greatest challenges most governance organisations face is scaling ocean and coastal management across jurisdictional boundaries and to the appropriate scales, namely, from local to sub-national, and from national to regional. This necessitates for governance measures to manage ocean resources, especially those within the EEZ and all current and future activities. Coastal regions and communities are beginning to recognise that they need to make themselves (and their diverse practices, histories and local knowledge) visible within the environment itself. Therefore, they need to put themselves on the map if they are to play an active role in emerging ecosystem-based and MSP approaches to marine resources (Ramulifho, 2014).

According to the UK Government Foresight Future of the Sea Project (2017) the application of spatial planning in the marine environment will provide a range of benefits, including:

a) Applying an ecosystem approach to the regulation and management of development and human activities in the marine environment by safeguarding ecological processes and overall resilience to ensure the environment has the capacity to support social and economic benefits (including those benefits derived directly from ecosystems),
b) Providing a strategic, integrated and forward-looking framework for all uses of the sea to help achieve sustainable development, taking account of environmental as well as social and economic objectives,
c) Identifying, conserving, or where necessary and appropriate, restoring important components of coastal and marine ecosystems,
d) Allocating space in a rational manner that avoids or minimises conflicts of interest and, where possible, maximises synergy across sectors.

These benefits clearly show that management of the marine environment is a matter of societal choice, which involves decision-making in terms of allocating parts of the ocean space to specific uses to achieve stated ecological, economic and social objectives (Douvere and Ehler, 2009). People are central to this decision-making process and are the agents for change. As such, stakeholder participation and involvement is integral to the success of MSP and creating a coordinated vision for sustaining our oceans. Increased stakeholder participation and involvement in the resource management decision-making process has its advantages and disadvantages and with increased participation comes the potential of conflicting interests and activities. The need for MSP and developing scenarios on sustainable ocean use is obvious. Participation, legislation, current and forecasted future conditions as well as hydrographic and economic datasets within the marine and maritime environment are not an option but a requirement to perform this task (Bergmaan, 2015).

Findlay (2017) commented on the Marine Spatial Planning Bill presented to the Parliamentary Portfolio Committee on Environmental Affairs-MSP Bill, identifying that "ecological governance is a process of informed decision-making that enables trade-offs between competing resource users so as to balance environmental protection with beneficial use in such a way as to mitigate conflict, enhance equity, ensure sustainability and allow accountability". Undoubtedly, the ocean economy provides unique opportunities to build the capacity of the participants, whether it is around fishing activities or coastal and marine tourism initiative, as this fosters social inclusion where the previously-denied and neglected black South Africans now have ample opportunities to participate.

4.5 DRIVERS FOR CHANGE AND SOUTH AFRICA'S OCEAN ECONOMY

Organisations and industries scan the environment to understand external forces of change so that they may develop effective responses that secure or improve their position in the future (Jansen Van Vuuren, 2002:107). Oberholster (2017) define environmental scanning as a process of gathering and interpreting information and using the results in the planning process. Inayatullah (2013: 16), further defines environmental scanning as "the acquisition and use of information about events, trends and relationships in an organisation's external environment, the knowledge of which would assist with planning the organisation's future course of action". A broader perspective has been adopted by Bhardwaj and Kumar (2014), they define environmental scanning as the collection and use of information about events, trends, and relationships in an organisation's external environment, the knowledge of which would assist management in planning the organisation's future course of action. In summary, the objective of environmental scanning is to identify changes that will influence an enterprise's activities. With the global drivers and issues shaping the ocean economy landscape identified in Chapter 3, the researcher utilised the STEEPLE analysis framework, with reference to the South African ocean economy, as the guideline for exploring the trends and emerging issues shaping this sector with the aim of identifying key drivers for change.

UK Department of Transport (2019) identified the long-term growth in seaborne trade as one of the key global trends influencing the direction of the ocean economy towards 2050. This means that the volume of goods transported by ships and demand for associated maritime services will grow steadily and this has also been the case for other countries as shown in the World Bank (2019) report. The ocean economy is significantly affected by the changing shape of world population. Developing countries, like South Africa, will see the greatest growth potentially shifting trading patterns and demands for imports and exports. The shift in the world economy eastwards and new emerging markets will have a significant impact on the ocean economy and other related sectors (OECD, 2019). New disruptive technologies are likely to emerge and change the ocean economy in ways we may not yet anticipate, including in the areas of artificial intelligence (AI), blockchain and digitisation (Groenfeldt, 2017). Climate change and significant climatic events will have an impact both on the resilience of the ocean economy and changing patterns of trade whilst also amplifying the need to act to protect the marine ecosystem and environment.

Section 4.5.1 is an environmental scan of the South African ocean economy. The researcher used the STEEPLE analysis framework, with reference to the South African ocean economy, as the guideline for exploring the trends and emerging issues shaping this sector with the aim of identifying key drivers for change and wild cards. Driving forces can change the course of progress as they set the preliminary developmental course, and are relevant and distinct forces, factors, or uncertainties that tend to be more immediate than megatrends (Adendorff, 2013). These are accessible by stakeholders and create or drive change within one's organisation, or institutional environment, which, although they can be adapted, can also strongly impact stakeholders (Saritas & Smith, 2011). Wild cards negatively influence a country's growth rate and may include factors such as unstable governance, disruption of its energy system, decline in education standards, unpredicted and unplanned rising population trends, which may cause tremendous strain on the economy of South Africa. Wild cards are known as low probability shock events that have very high impacts, thereby altering "the fundamentals and creating new trajectories which can then create a new basis for additional challenges and opportunities that most stakeholders may not have previously considered or prepared for" (Saritas & Smith, 2011:295).

4.5.1 Social drivers for change

The social aspect of the analysis looks at features such as demographics, education levels, income levels and perhaps the age distribution of the population or customer base**.** Population is a major driving force for the future development of the global environment as well as the growth of societies (Bongaarts, 2009; Williams, 2019). The number of people currently residing on earth is widely acknowledged to be an important variable in influencing ecosystem condition and planning (World Bank, 2018). There is also a growing recognition that how population is distributed across age groups, urban and rural regions, living arrangements, and geographic regions affects consumption patterns and, therefore, ecosystem impacts. Researchers highlight demographic drivers for change with considerations around human populations such as growth rates, composition, age profiles, human movement and other features. Planners consider demographic trends as critical for policy and decision-making in both the public and private sector (Shediac, Bernnat, Moujaes & Najjar, 2011).

Adendorff (2013) affirms the important role that education plays in reducing disadvantages such as child labour, gender equality and the protection of human rights. The promotion of national literacy is key, where important skills such as reading, and writing are fundamental for national development. While the positive effects of education can be seen in nutrition, health, population control, productivity and entrepreneurial activity, it acts in a manner in which individuals can reconstruct and sustain livelihoods to contribute towards nation building (Hymel, Loeppke, Baase, Burton, Hartenbaum, Hudson, McLellan, Mueller, Roberts, Yarborough, and Konicki, 2011; Adendorff, 2013). Over the next decade, it is believed that illiteracy rates will drop significantly. South Africa has fairly high adult literacy rates with 88.9% of adult males and 87.2% of adult females currently being considered to be literate (Adendorff, 2013). Accelerating technological advancement complicates social drivers of change, requiring major improvements to education systems (WEF, 2019).

The South African International Maritime Institute (SAIMI) (2017) indicated that given the strategic importance of the ocean economy to South Africa, over 90 institutions around the country offered maritime-related programmes, building and maintaining the critical mass of skilled people on which the sector's successful businesses depend. Students come from all over the African continent, including Namibia, Kenya, Nigeria, Ghana, Mozambique Tanzania and Angola to study at these institutions. A wide range of maritime and marine-related degree programmes are offered by South Africa's public universities, as well as programmes in subjects that support the wider ocean economy, such as civil and mechanical engineering, law, medicine, economics and business studies (SAIMI, 2017).

The skills profile of the maritime sector will change significantly over the next 30 years (SAIMI, 2019). The importance of STEM subjects will increase as jobs become more skilled and data driven in response to new technology (UK Department of Transport, 2019). Industry roles will be multidisciplinary, potentially requiring the ability to create, operate and maintain autonomous and technological systems. There is an opportunity to expand high-quality training programmes to meet new requirements and explore ways to bolster the programmes that institutions offer to enhance and promote ocean economy development, locally, nationally and globally.

As a developing economy, South Africa has struggled with issues associated with poverty for a long time. From the onset of democracy in 1994, reducing poverty and inequality has been a key focus of South Africa's development policies and programmes with the implementation of the Reconstruction and Development Programme (RDP) as well as the current National Development Plan: Vision 2030 (National Planning Commission, 2011). While significant progress has been made since 1994, South Africa continues to face difficult challenges associated with high poverty, high inequality and high unemployment (StatsSA, 2017; World Bank, 2018).

4.5.1.1 South African context

In relation to the ocean environment, South Africa's population trends emphasise the need for employment creation in non-traditional economies such as those found in the ocean economy (Department of Environmental Affairs, 2014; Adendorff & Collier, 2015). South Africa is currently witnessing a surge in the numbers of young people (in 2003 more than 40% of Africa's population were below the age of 15), whereas developed countries' populations are getting older (FAO, 2014; Williams, 2019). According to the African Development Bank (2016a), Africa has the world's youngest populations, contrary to those of the West where countries are burdened with ageing population. Through the investment in education and training for the African youth, the social dividend thereof would produce economies that are dynamic and productive. The prominent role that the African youth will play in the economy (that includes the ocean economy) and natural resource management cannot be undervalued.

South Africa offers world-class education, training and certification for seafarers, ranging from high school subjects to university qualifications (SAIMI, 2017). Many of the Southern African courses and qualifications are internationally-recognised and in accordance with the International Maritime Organisation's conventions (SAIMI, 2017). Maritime studies are a strategic area for skills development in South Africa, with subjects such as Maritime Economics and Nautical Science being introduced at some high schools. In addition to public universities, universities of technology, and technical vocational education and training colleges, more than 55 private institutions offer maritime-related training (SAIMI, 2017; Williams, 2019).

4.5.1.2 Social wild cards

The wild cards associated with social factors are particularly hard-hitting as any stimulation of social risks has the potential to drive further inequality and socio-economic disruption. Wild cards were introduced by Peterson (1997) as cited in Inayatullah (2013) and are also called surprises or shocks or discontinuities in the environment. In future studies, wild cards refer to happenings improbable, but very effective if they happen. Wild cards study could lead to sensitive points, namely, that if change occurs, they may have a huge effect. This is the same hypothesis behind the butterfly effect that there are sensitive points, so that the initial conditions in a system could be so critical for the future of the system. There are many possible wild cards associated with social factors, but the issue surrounding education and migration patterns, especially towards coastal cities, seems to be one of the most prevalent at present, sending a weak signal for what could potentially be the occurrence of a catastrophic wild card event, namely, an [2] unmanageable ocean economy for South Africa.

4.5.2 Technological drivers for change

Advances in the ocean economy go hand-in-hand with innovations in science and technology (OECD, 2016). Galvanised by digitalisation, the transformation of scientific research and innovation processes is speeding up in many parts of the world, in almost all disciplines and sectors of the economy. The adoption of disruptive technologies (for example, artificial intelligence, big data, blockchain) is affecting academic research areas and business innovation cycles alike. The promotion of collaborative and open innovation is also changing the way researchers are training and working together. At the policy level, national research agendas are increasingly emphasising the need to tackle *grand challenges* in multiple economic, societal and environmental areas. Information and communication technology in Africa has and continues to be a significant driver of socio-economic change, resulting in an increase in economic participation in the global economy (United Nations Economic Commission for Africa, 2016; Groenfeldt, 2017). Internet users in Sub-Saharan Africa are few when compared to international standards (UNDP, 2014), whilst cellular phone penetration has dramatically increased, with an average of 5.4% subscribers for every 1 000 people (Rakodi & Nkurunziza, 2007 cited in UNDP, 2014). On the other hand, several African countries that are more developed (including South Africa) have an average of between 20% and 40% subscribers for every 1 000 people (UNDP, 2014).

According to the (OECD, 2016), ocean technologies correspond to technologies used for renewable energy production, deep-sea mining, freshwater production from sea, offshore structural components, ocean acoustics, seabed classification, modelling of oceanic processes, ocean electronics, marine biotechnology, aquaculture as well as

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[2] An unmanageable ocean economy refers to a situation where it will be difficult or impossible to manage or control ocean economy activities making it difficult to promote sustainable development and growth around all six ocean economy sectors.

coastal and environmental engineering. With over 95% of internet traffic transmitted via undersea cables, the WEF (2019) also cites that data may not only be sent, but also stored underwater, which could be another technological transformation facilitated by the ocean economy. High energy costs of data centres (up to 3% of global energy use) have driven their relocation to places like Iceland, where cold climates increase cooling efficiency (WEF, 2019). Meanwhile, about 40% of people on the planet live in coastal cities. To simultaneously cope with high real estate costs in these ocean front growth centres, reduce latency and overcome the typically high expense of cooling data centres, Microsoft successfully tested a prototype underwater data centre off the coast of California (WEF, 2019). In addition, next-generation underwater cloud pods may be hybridised with their own ocean energy-generating power plants.

The shift in economic power and great acceleration in middle-class growth, consumer demand and urbanisation over the past few decades has also coincided with extraordinary progress in communications and technology (WEF, 2017). This has enabled societies to become more connected and have more data to a degree impossible to conceive even just 25 years ago at the time of the first Earth Summit. The World Economic Forum (2017) terms this explosion in access to a copious and mobile internet, by smaller and more powerful sensors that are becoming ever cheaper, and characterised by artificial intelligence and machine learning, as the Fourth Industrial Revolution. The adoption of disruptive technologies (for example, artificial intelligence, big data, blockchain) is starting to affect academic research areas and business innovation cycles within the ocean economy (OECD, 2019). The potential of those technologies to South Africa and the African continent are vast in terms of their future contribution to energy supply, production process, drug development and seabed management (Adendorff & Collier, 2015; Department of Environmental Affairs, 2016).

4.5.2.1 South African context

The Department of Science and Technology (2012) as cited in Williams, 2019) state that the landscape of science, technology and innovation in South Africa is making effective use of South Africa's existing strengths to respond to changes in a global context to meet the country's needs towards 2050. The Department of Environmental Affairs (2014) further indicate that technology is, therefore, playing a significant role in ocean economy development in the country. With a 92% per 100 people mobile phone penetration, the South African population increasingly has internet access and researchers warn that the government should not underestimate the role of social interaction in determining demands (Lemire, 2011). In the coming decades, South African scientific and technological advances are expected to play a crucial role in the further development of ocean-based economic activities (Hussen et al 2000; Adendorff & Collier, 2015; Mare, 2012; OECD, 2016). Most researchers contend that every sector of the ocean economy in South Africa stands to be affected by technological advances, therefore, the future growth of the ocean economy of South Africa.

4.5.2.2 Technological wild cards

A number of countries have successfully harnessed the digital revolution to enable broader socio-economic development. But South Africa has fallen behind. It has slid down the International Telecommunications Union's Information Society Index (Conversation, 2020). The index measures the countries' evolution towards becoming information societies based on three measures, namely, readiness, intensity and impact. For instance, readiness is measured through indicators of access and skills. The World Bank (2018) index places South Africa 104th out of 144 countries in terms of access to fixed broadband, down from 77th in 2002. Leveraging specific technologies that are currently causing widespread disruption, for example, artificial intelligence, internet of things (IOT), genetic modification, robotics and 3D printing will be crucial for the future of the ocean economy (World Bank, 2018). In the coming decades, South African scientific and technological advances are expected to play a crucial role in the further development of the key six ocean-based economies (Adendorff & Collier, 2015; Mare, 2012; OECD, 2016). Most researchers contend that every sector of the ocean economy in South Africa stands to be affected by technological advances, therefore, the future growth of the ocean economy of South Africa.

4.5.3 Economical drivers for change

The economic world is in the midst of a massive, long-term shift in wealth and economic power from West to East as the global economic system is being reconstructed with the rise of new economic powers emerging as well as the changing influence of *non-state* players (Grant, 2010; Williams, 2019). Additional to the shifts in the economic world, there are similar shifts in the range and scope of transnational issues that will impact upon the economic prosperity of the world. Energy demands, water and food insecurities, ageing nations and climate change are diminishing ongoing world economic prosperity (WEF, 2013).

In the economic analysis, the researcher considered aspects of the external environment as tax rates, economic growth measured by gross domestic product, and the consumer confidence index. The South African economy is characterised, on the one hand, as developed and able to compete with other countries in mining, manufacturing, agriculture and services. On the other hand, the country is characterised as a developing country, with challenges in infrastructure, economic inequality, high unemployment rate (a primary source of poverty, which could fuel social instability and violent strife against the government) (British Broadcasting Corporation, 2010; Bureau of African Affairs, 2010; Essel, 2012; Central Intelligence Agency, 2010; Central Intelligence Agency, 2017 in Williams, 2019).

4.5.3.1 South African context

South Africa's rich and productive coastal waters support thousands of jobs and contribute millions of rand to the national economy each year, with coastal goods and services estimated to contribute 35% to South Africa's gross domestic product (GDP) (WWF-SA, 2016). Currently, the ocean economy initiative is in implementation phase with government claiming that it has unlocked investments amounting to US$ 1.1 billion and, as a result, 4500 jobs have been created (Invest South Africa, 2016: 2). At the core of these optimistic economic projections is the ongoing implementation of Operation Phakisa to unlock the economic potential of the country's ocean economy through six focus areas in which at least 47 detailed initiatives are at various stages of roll out (Department of Environmental Affairs, 2014; Department of Environmental Affairs, 2016). Long-term projections are highly-optimistic that by 2033 South Arica's ocean economy could contribute up to R177 billion to GDP with the creation of one million jobs (Department of Environmental Affairs, 2016).

The potential of the ocean can assist South Africa and the continent in achieving the future demand is huge (Adendorff & Collier, 2015; OECD, 2016). To meet the future demand, it will require South Africa (including Africa) to fully harness the potential of the ocean by substantial the expansion of many ocean-based economic activities (Adendorff & Collier, 2015; OECD, 2016; Williams, 2019). Considering the expected increase in the South Africa population by 2050 and the demand for food, the ocean clearly has an important part to play in supplementing the food supplies generated by the agriculture industry. Additionally, the quest for energy resources is being driven by increasing demand by a growth South African population (Adendorff & Collier, 2015; OECD, 2016).

4.5.3.2 Economic wild cards

The ocean economy continuous to play a critical role for centuries in the growth and development of coastal nations as a primary facilitator of global trade and economic growth (UK Department of Transport, 2019). Offshore oil and gas exploration (including deep sea mining) contribute in many ways to the economy growth rate, but the absence of proper biodiversity and ecosystem management can have a degrading impact on dwindling fish resources, particular to coastal communities making a living from the sea. The ocean economy, which contributes upwards of $1.5 trillion in value added to the global economy, was particularly hard hit by the COVID-19 pandemic, with a projected loss of $1.9 billion for international shipping carriers alone (World Resource Institute, 2021). Coastal communities were hardest hit, with an estimated $7.4 billion fall in GDP across small island developing states owing to the decline in tourism. The links between ocean-based sectors and land-based economies mean that these impacts have economic and social repercussions across the entire economy. This will even be more challenging for South Africa with seaborne trade accounting for about 90% of products per volume leaving and entering the country. Shipping has no economic throughput, as indicated in the Shipping Economic Study (Department of Transport, 2011; SAMSA, 2018) because South Africa continues to have only four vessels on its shipping registry (SAMSA, 2020).

4.5.4 Environmental drivers for change

WEF (2017) emphasises that four of the top ten global risks are categorised as environmental factors, with extreme weather events being the most likely to occur, which is second in terms of the largest impact, namely, *weapons of mass destruction*. According to the study, natural disasters are the second most likely to occur, potentially having the third largest impact, while failure of climate change mitigation and adaption is the fifth most likely to occur, and the fourth most impactful risk (WEF, 2017). Governments have the responsibility to create and put in place appropriate incentives for business and consumers to make choices that can assist and prevent future environmental issues (Adendorff, 2013; Lee, Kim & Kim, 2018; Laughland & Bansal, 2011 in Koekemoer, 2019).

Expert scientific consensus confirms that the world is entering a worrying period of change and uncertainty for the ocean (Hoegh-Guldberg and Ridgway, 2016). Not only is too much being drawn on primary marine assets, which directly threatens the value of the annual dividend from the ocean, but also the impacts of climate change are already manifesting themselves (Hoegh-Guldberg and Ridgway, 2016). Human activities such as burning fossil fuels and deforestation have increased the Earth's average surface temperature by over 0.85°C during the period 1880 to 2012 (IPCC, 2014), and there is a high level of confidence that global warming will place additional pressure on the ocean through increased sea temperatures, acidification of ocean waters, and an increase in sea level (Lluch-Cota, Hoegh-Guldberg, Karl, Pörtner, Sundby and Gattuso, 2014). Rising ocean temperatures are driving the expansion of marine dead zones, changing the flow of ocean currents, increasing diseases, changing productivity, and causing a decline in kelp forests and coral reefs worldwide (IPCC, 2013; Bakun et al, 2010; Lluch-Cota et al, 2014). Climate change is increasingly becoming one of the dominant drivers of change in vulnerable habitats such as mangroves, coral reefs and coastal wetlands, which are especially at risk from resulting sea-level rises and increased storm events. Coral reefs are vulnerable to climate-change-induced bleaching. It has been suggested by many that coral mortality through global warming will reduce the major coral reefs substantially in a very short time frame, with one estimate even suggesting that all current coral reefs could disappear by 2040 owing to warming sea temperatures.

People's demands on nature are a function of population size, economic activity and consumption levels. According to the United Nations Data (2020), the population for South Africa as at March 2020 was estimated at 59 308 690. South Africa is one of the African countries that are also experiencing some of the world's highest rates of urbanisation, with many of the evolving cities unplanned and associated with growth of informal settlements, inadequate housing and basic services and urban poverty (National Planning Commission, 2011). In 2016, the United Nations Food and Agriculture Organisation (FAO) estimated that marine capture fisheries produced 79.3 million metric tons (mmt) of landings, representing 46.4% of global seafood production (170.9 mmt) and $130 billion in first sale value (FAO 2017). The FAO (2017) report further estimated that approximately 30.6 million people participated, either full-time, part-time or occasionally, in capture fisheries, operating approximately 4.6 million fishing vessels. Small-scale fisheries are the backbone of socio-economic well-being in many coastal communities (Béné et al, 2007, 2010) and with global populations predicted to reach approximately nine billion by 2050, this will certainly place more pressure on the ocean environment.

Climate change is also significantly altering the ability for marine fisheries to provide food and income for people around the world (IPCC, 2019). Hoegh-Guldberg, Poloczanska, Skirving and Dove (2017) estimate that ocean warming has already driven a 4.1% decline in the maximum sustainable yield (MSY), the maximum amount of catch that can be harvested for perpetuity, of 235 of the largest industrial fisheries over the past 80 years. In general, well-managed fisheries have been the most resilient to these changes, while overexploited fisheries have been the most vulnerable O'Neill, Kriegler, Riahi, Ebi, Hallegatte, Carter, Mathur and van Vuuren (2014). The EIU (2015) and Williams (2019) further argue that new opportunities are emerging for investing in ocean health and ecosystems, which comprise of activities around the mitigation of, and adaptation to, climate-change challenges (building nature into coastal infrastructure for added resilience, for instance), marine protection infrastructure and services, wastewater and ocean nutrient pollution management as well as ocean monitoring and surveillance. In addition, Williams (2019) cites that there are the new investment and financing instruments around non-market assets and services (investing in marine protected areas, blue bonds, and in the health of special ecosystems such as mangroves).

4.5.4.1 South African context

South Africa has a rich endowment of natural resources. As with many other developing economies, South Africa hopes to address environmental issues while hoping to see its economy grow. However, in the process of economic development, while increasing production and improving infrastructure, South Africa would likely exploit its resources excessively, resulting in harmful effects in the environment (Adendorff, 2013). Climate change remains a key concern within South Africa as the mean annual temperatures have increased by at least 1.5 times the observed global average over the last five decades while extreme rainfall events have continued to increase in frequency (Ziervogel, New, van Garderen, Midgley, Taylor, Hamann, Stuart-Hill, Myers and Warburton, 2014). While South Africa has made significant progress in understanding the impact of climate change as well as implementing and evaluating appropriate adaptive responses, there are two areas that still need substantial work. These are i) Inadequate impact assessment and the quantification of the socio-economic costs of climate change and ii) Institutional challenges that make it difficult for organisations in both the private and public sectors to work and collaborate effectively to meet the country's adaption needs (Ziervogel et al, 2014).

4.5.4.2 Environmental wild cards

With the increasing quantities of carbon dioxide (CO_2) being pushed into the Earth's atmosphere, the oceans are slowly becoming more acidic (IPCC, 2014; OECD, 2016; World Bank, 2018). An increase in acidity means that many plant and animal species will struggle to build and maintain their skeletons or shells. A far more sinister effect is that the acidity can tamper with the bodily functions of all ocean creatures, interfering with growth or reproduction (FAO, 2016). Visbeck and Schneider (2018) argues that in responding to challenges posed by ocean acidification, the way energy is produced and used will need to change as well as how land is managed. Visbeck and Schneider (2018: 381) further states that "ocean acidification is a global process with local impacts on fisheries and coastal communities, therefore, there is a need to act urgently at all level". Sea temperatures in the coastal boundary systems (of which the African region forms a part) will continue to increase over the next few decades and centuries (Lluch-Cota, 2014). Under business as usual (IPCC, 2014), sea temperatures are projected to increase by 0.62°C to 0.85°C over the near term and 2.44°C to 3.32°C over the long term (Lluch-Cota, 2014). It only takes a temperature increase of 1-2°C to cause corals to bleach, and it is likely that coral bleaching and mortality will occur every 1 to 2 years by the mid- to late part of this century under low to high climate change scenarios (Lluch-Cota et al, 2014). Mass mortality events that affect coral reefs will result in changes to community composition in the near term and a continuing downward trend in coral cover in the longer term (Gardner et al, 2003; Bruno & Selig, 2007).

4.5.5 Political drivers for change

The study of world politics comprises a broad range of disciplinary and theoretical perspectives. Politics in itself is multifaceted but can broadly be understood in reference to the governance of human communities (World Bank, 2018; Koekemoer, 2019). Robock (1971) explains that government actions are always driven by politics. Significant economic decisions are often made by political leaders who often are driving an agenda to achieve their own political desires (Adendorff, 2013). Governance (whether it is local, national or regional) relies on the maintenance of values and principles that the public hold true (Adendorff, 2013). Political relations between state, civil society and the private sector all heavily depend on appropriate governance, even though the purposes of the sectors vary greatly and are affected by the priorities and principles of a set social system (Adendorff, 2013; Koekemoer, 2019).

4.5.5.1 South African context

The focus on the quality of African governance has become intense in recent years with many political analysts arguing that it must improve as a precondition for successful broader development (Koekemoer, 2019). Since apartheid, South Africa has made significant progress in building the structures of a well-functioning democratic state. The fragmented governance structures that were in place during apartheid have been consolidated into a system that is designed to serve developmental objectives (Adendorff, 2013; Rembe, 2006 in Koekemoer 2019). Williams (2019) further summarises South Africa's political landscape as a multi-party parliamentary democracy (Bureau of African Affairs, 2010; Essel, 2012), with numerous notable pressure groupings such as civil society, organised labour and business (Pekeur, 2003; Essel, 2012) that is generally associated by foreign investors with corrupt (Zaayman, 2003; Silke, 2011).

Political instability in South Africa, as with many other developing economies, has strong links to internal and external special interests (Adendorff, 2013; Koekemoer, 2019). Political tensions in 2016 and 2017 caused by leadership issues within the ruling African National Congress (ANC) raised international business concerns about South Africa's investment environment (Control Risks, 2018). In the 2017-2018 Global Competitiveness Report, Schwab (2017:34) notes that South Africa remains one of the most competitive countries in sub-Saharan Africa, being one of the region's most innovative nations during a time when the economy is nearly at a standstill in terms of growth. Schwab (2017) emphasises that political uncertainty in 2017 has decreased the confidence of South African business leaders, noting that, while it is still relatively good in the African context, the country's institutional environment, financial markets and goods market efficiency are all rated weaker than in the previous survey of 2016.

From a political economy perspective, Satgar (2018:24) sees the planning of the blue or ocean economy in South Africa as a scramble for "a new spatial fix for capital accumulation", which is taking place in a wider context of growing "resource nationalism". The envisaged big and fast results from Operation Phakisa are underpinned by a methodology "that evangelises growth and foreign direct investment" (Satgar, 2018: 24). This extension is now to include offshore extraction of oil, gas and other minerals and is allied to massive port infrastructure investments, which are designed "to boost the outward movement of commodities, like coal and increase massive imports" (Satgar, 2018:25). In scathing commentary, Satgar (2018:25) asserts that this "drumbeat, fastened to a fast-track methodology, has undermined the efficiency of environmental impact assessments, prompted deregulatory thrusts in key legislation and failed to appreciate serious (environmental) risks". Arguably, the numerous environmental costs of South Africa's ocean economy strategy have been either downplayed or simply ignored. Moreover, as Masie and Bond (2018: 315) point out, the project's "overhyped GDP-led evaluation of the ocean's potential did not sufficiently balance short-term economic and political gains – which are mainly grabbed by multinationals corporations (in oil and shipping), political oligarchs and well-connected entrepreneurs – against Phakisa's massive eco-social destruction".

In terms of the future for South Africa's ocean economy, the country is in a position to redevelop a large amount of its policy in this area, should it choose to, and set leading continental and global standards. With the growing value of marine space and the growing demand for marine resources, combined with new technologies enabling greater exploration and resource extraction is likely to increase the value of marine space. The political implications for this are uncertain but could include increasing marine policy initiatives and growing competition between countries over marine territory. South Africa's maritime history and marine strengths and interests provide a natural platform for international engagement, at a time when the sea is projected to become a higher priority issue.

4.5.5.2 Political wild cards

Owing to their nature, political risks often evolve over time and start to escalate as momentum is gained. Often, this is not seen by the public nor by those individuals who are most impacted upon until it is too late to react appropriately. The research and development of possible wild cards are fundamentally important for this very reason. Given the South African political landscape, some elaboration is provided on a few examples of potential wild c that fall within the scope of the political risk banner. Firstly, the consideration of systemic xenophobic attacks in South Africa is an important wild card given the history of xenophobia in South Africa. Post-apartheid South Africa has been subject to many xenophobic incidents, with the month May in the year 2008 noting one of the largest spikes in xenophobic-related violence in the recent past (Charman & Piper, 2012; Pillay, Barolsky, Naidoo, Mohlakoana, & Hadland, 2008). May (2008) saw a sudden rise of xenophobia, leaving 62 people dead after a series of attacks originated in Alexandra, Johannesburg (Pillay et al, 2008). With 1 400 suspects arrested in connection to the violence, a year later only 128 individuals were convicted with 30 being found not guilty and 208 cases withdrawn (Pillay et al., 2008). Over 200 000 people were displaced during the 2008 xenophobic attacks, highlighting the destabilising effect that a particular wave of xenophobia may have (Maharaj, 2018). There has been a steady increase in the expression of xenophobic sentiments at both the level of officials within the state, as well as in popular discourse in the country (Maharaj, 2018).

The next consideration for a potential wild card seems to be a major theme in South Africa at present, namely, embedded corruption. While the idea of systemic embedded corruption is a complex issue in its own right, the changes in South African political dynamics over 2017 and 2018 have brought much of the current issues to light with the *state capture inquiry* providing public insight into a topic that previously avoided public scrutiny. The judicial commission of inquiry into state capture was established to inquire, investigate and make recommendations into any and all allegations of state capture, corruption and fraud in the public sector (Smit, 2018).

4.5.6 Legal drivers for change

The legal drivers of change can be seen from two different perspectives, namely, the external legal environment as well as the internal legal structures that govern business activities. Abbott and Snidal (2002) notes that laws can affect the business environment in different ways, depending on jurisdictions, while companies also often put policies in place that they adhere to in order to drive appropriate behaviour. The term *governance* is commonly used to describe the way in which countries, companies and societies are governed in terms of legislation or policy (Adendorff, 2013). Strong governance is often associated with a government that provides quality service to the society or community, where the decision-making process is transparent, participative, accountable at all times and under legal and societal scrutiny at all times (Adendorff, 2013). Legal drivers for change consider various aspects of the legal environment to chart appropriate strategies in light of this legislation (Abbott and Snidal, 2002).

At the global level, the United Nation's Convention of the Law of the Sea (UNCLOS, 1982) provides a comprehensive structure for dealing with human activities in the oceans and the legal framework to regulate key aspects of resources in the sea and uses of the ocean. These include navigational rights, territorial sea limits, economic jurisdiction, the legal status of resources on the seabed beyond the limits of national jurisdiction, passage of ships, conservation and management of living marine resources, protection of the marine environment, marine research regimes, and binding procedures for the settlement of disputes between states. Key to an effective response to Africa's ocean economy is an integrated legal, regulatory and institutional framework that is geared for frequent features in terms of cooperation and coordination arrangements for the institutional actors that can foster co-operative efforts as well as build the legitimacy of any necessary and strong enforcement action (OECD, 2014; Williams, 2019). According to the National Department of Transport (2017) and Williams (2019), African governments have the primary responsibility for policies that enable the continent's people to benefit from the maritime industry. South Africa's ocean economy spans over a number of different sectors, with significant potential synergies, provides positive incentives for moving toward better integrated legal, regulatory and institutional frameworks (UNECA, 2016).

Before Operation Phakisa was implemented there was no overall system in place to guide ocean governance and marine resources were managed sectorally. The introduction of Operation Phakisa as a method that can fast tracked the growth and development of key ocean economy industries could result in conflict between user groups as well as unsustainable use of ocean resources and failure to capitalise on development opportunities. The Marine Protection Service and Ocean Governance stream of Operation Phakisa aims to develop an overarching, integrated ocean governance framework for the sustainable growth of South Africa's ocean economy. Marine Spatial Planning and Marine Protected Areas are also important components involving a public process of analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic and social objectives.

4.5.6.1 South African context

South Africa takes great pride in having one of the most progressive constitutions in the world and where the country's strong legal and regulatory structures promote increased business opportunities (Department of Environmental Affairs, 2014). South Africa is considered to be in line and compliant with regard to the legislative and regulatory developments in ocean economy and its key six sectors, in comparison to other coastal states in the continent. The development of a South African ocean economy that leads to substantial economic growth and job creation lies at the heart of its maritime and ocean governance policies and practices at national, regional and international levels. To achieve this development, it is attempting to successfully align and implement numerous domestic and foreign policies and strategies. These are also expected to achieve positive security and developmental outcomes in the region and beyond. The successful implementation of the Ocean Governance Objectives and priorities will allow South Africa, in the next five years, to complete the move from sectoral ocean planning and management towards coordinated sectoral environmental management.

4.5.6.2 Legal wild cards

Overregulation of systemically important maritime or ocean related institutions and the possible effects of such a situation occurring is a possibility where regulators (nationally, regionally and globally) will completely over-regulate the growth sectors within the ocean economy. With the shifting to Africa as the next big economic battle field or rather ocean for the exploration of natural resources, the maritime sector cannot ignore this with the focus on the legal ownership and clear policies on ocean resources in the open seas. Clear policies on ownership and governance of these resources, particularly within a large union or group of countries, will become important to sustain investments and growth. This also calls for a much greater role by the private sector and international cooperation with other entities such as the European Union (EU).

4.5.7 Ethical drivers for change

Ethical values provide a basis for what is right and what is not. The ethical ideas of a country will not change overnight, and it is important that countries must continuously check their values, norms and ethical factors. Responsibility is one of the values that the human community accepts as universally representative of individual and social good in terms of honesty, justice as well as respect for life and the environment (Barbier et al, 2018). This new conception of the ethics of the future goes far beyond philosophical theory in influencing national and international legal or political systems to integrate the concepts of “common heritage of humanity”, “sustainable development” and “future generations” (Gaillard, 2015; Mantatov & Mantatova, 2015).

4.5.7.1 South African context

The ocean is beneficial in numerous ways and humans derive various benefits from the oceans through active participation in the ocean economics, which involve the ecosystem and environmental services (Barbier et al, 2011). Recent years have seen a renewed effort in South Africa, especially with the Operation Phakisa strategy, to utilise the ocean economies sectors to foster economic growth, create employment tap the food and energy resources in the oceans for human needs. Similarly, possibilities to innovate and promote sustainable entrepreneurial activities and the use of ocean resources for sustainable economic development and growth to promote equality remains key in South Africa (Kim & Mauborgne, 2014).

4.5.7.2 Ethical wild cards

Corruption and a widening inequality gap will be detrimental for the ocean economy. Ensuring a sustainable ocean economy entails protection, preservation and conservation of the ocean space so as to protect endangered ecosystems and species. So, it is critically important to ensure that adequately skilled and competent people are allowed to champion all the key priority sectors**.**

The need for South Africa to balance the economic, social and environmental dimensions of sustainable development in relation the country's ocean is a key component to address the environmental drivers of the ocean economy (Adendorff & Collier, 2015; World Bank Group, 2017). In the coming decades, scientific and technological advances are expected to play a crucial role in addressing many of the ocean-related environmental challenges facing South Africa and Africa (Mare, 2012; Adendorff & Collier, 2015; OECD, 2016). The environmental and social impacts upon each of the African (established or the emerging) marine industries as well as their potential economic benefits, are unique to each of the countries of the continent, South Africa, in particular (Adendorff & Collier, 2015; World Bank Group, 2017). Table 4.2 summarise the drivers for change in the South African ocean economy and the possible wild cards that could potentially be the occurrence of a catastrophic wild card event in ensuring a sustainable ocean economy for South Africa towards 2060. Ocean's usefulness is immense, and it should be protected from illegal harvesting, degradation and depletion and, at the same time, protected from harmful activities and pollutants. Protecting the ocean and its species, habitats, landscapes and seascapes should be paramount and should be done in such a way that there are integrated developmental strategies for present and future generations.

Table 4.2: Drivers for change in the South African economy

Driver	South African context	Wild cards
Social driver	Population trends: employment creation needed, education and training are strategic areas for skills development.	Wild cards: inequality and socio-economic disruption, migration patterns and sustainable ocean economy.
Technological driver	Most researchers contend that every sector of the ocean economy in South Africa stands to be affected by technological advances (namely, higher and cheaper internet, automation), therefore, the future growth of the ocean economy of South Africa.	
Economic driver	Long-term projections are highly-optimistic that by 2033 South Arica's ocean economy could contribute up to R177 billion to GDP with the creation of one million jobs.	The links between ocean-based sectors and land-based economies mean that negative impacts (namely, global recession, COVID-19) have economic and social repercussions across the entire economy.
Environmental driver	Ocean's usefulness is immense, and it should be protected from illegal harvesting, degradation and depletion and, at the same time, protected from harmful pollutants.	In responding to climate change and to challenges posed by ocean acidification, South Africa will have to change the way energy is produced and used, and the way land is managed as well.
Political driver	Governments have now recognised that to take advantage of the potential that innovation represents for their citizens. They must adopt friendlier policies that assist with technological catch-up and the absorption of knowledge so that firms can build global innovation networks and promote growth within the ocean economy.	Post-apartheid South Africa has been subject to many xenophobic incidents, political instability and a corrupt state will not build the ocean economy.
Legal driver	South Africa is considered to be in line and compliant with regard to the legislative and regulatory developments in ocean economy and its key six sectors, in comparison to other coastal states in the continent	Overregulation of systemically important maritime or ocean related institutions (nationally, regionally and globally) will completely over-regulate and might kill the growth sectors within the ocean economy.

Driver	South African context	Wild cards
Ethical driver	Recent years have seen a renewed effort in South Africa, especially with the Operation Phakisa strategy, to utilise the ocean economies sectors to foster economic growth, create employment as well as tap the food and energy resources in the oceans for human needs.	Ensuring a sustainable ocean economy entails protection, preservation and conservation of the ocean space so as to protect endangered ecosystems and species. So, it is critically important to ensure that adequately-skilled and competent people are allowed to champion all the key priority sectors

Source: Researcher's own construction.

4.6 CHALLENGES IN THE SOUTH AFRICAN OCEAN ECONOMY

South Africa's ocean ecosystems face irreparable damage unless human activities are better regulated, and marine life is protected through better governance (Walker, 2018). Yet, South Africa is also in urgent need of sustainable development and it has chosen the oceans as a site for major investments and activities designed to make this happen. This has not been a simple process. Being a developing country, South Africa will have challenges dealing with the consequences of population growth outgrowing economic growth. Adendorff and Collier (2015) highlight some key implications for South Africa and Africa, namely, a shortage of freshwater, increasing food insecurity, deforestation, accelerated depletion of scarce, natural resources leading to higher commodity prices, slowed progress in improved child and maternal health as well as an increase in global Greenhouse gas emissions.

In 2009, former president Jacob Zuma established the National Planning Commission, led by Trevor Manuel, a former finance minister, to draft a National Development Plan (NDP). The NDP was delivered in 2012 with the aim of signposting ways of increasing development to tackle South Africa's *triple threat* of high levels of inequality, poverty and unemployment by 2030. These challenges are huge, structural and not easily overcome. Unemployment in 2017 stood at 27.7% and South Africa achieved sluggish economic growth over the past decade and dipped into recession in 2017 (StatsSA, 2017). Youth unemployment stood at an estimated 67.4% in 2017.

The National Development Plan (NDP) and National Growth Path (NGP) have been developed as mechanisms to drive development in South Africa highlighting the areas that require an urgent action to improve GDP growth, job creation and poverty alleviation. In response to this, the President of the Republic, launched Operation Phakisa: Ocean Economy Big Fast Results programme that was meant to fast-track implementation on ocean's economy initiatives in the country.

South Africa's population trends emphasise the need for employment creation in South Africa (United Nations Medium Variant Report, 2010; Adendorff & Collier, 2015), and the demand for food security will be larger from the sub-Saharan, African population, both for agricultural and marine output, both domestically and internationally (United Nations Medium Variant Report, 2010; Adendorff & Collier, 2015). Park and Kildow (2014) and Mohanty et al (2015) argue that the world's (South Africa, in particular) ocean economy, if truly sustainably exploited, will be able to address challenges (such as employment creation and food security) associated demographical trends. South Africa's fisheries and aquaculture sector as the economic activity related to the production, processing and distribution of seafood will be important in the future, to address employment creation and food security (Mohanty et al, 2015; Park and Kildow, 2014). In addition, prospects of other employment opportunities in the ocean economy such as marine mining, maritime manufacturing as well as maritime industries and services will be able to further mitigate South Africa's population demographical trends in addressing unemployment and offering alternative industries for economic growth (Adendorff & Collier, 2015; Mohanty et al, 2015; Park and Kildow, 2014).

4.7 KEY DRIVERS UNDERPINNING THE GROWTH OF SOUTH AFRICA'S OCEAN ECONOMY

An updated study by consultancy firm PwC, "The World in 2050", projected South Africa to be the seventh-fastest growing economy between now and 2050, with an average annual real growth rate of 5% (PwC, 2015). The report also predicted that in purchasing power parity terms, the E7 group of emerging countries (which include China, India, Brazil, Russia, Mexico, Indonesia and Turkey) will overtake the G7 economies (USA, Japan, Germany, UK, France, Italy and Canada) by 2020 (PwC, 2015). South Africa's ocean environmental management policy aims to encourage and support sustainable development of the South African marine environment by focussing effort on methods which contribute to Habitat and Biodiversity Conservation, Marine Ecosystem Management and Maintaining Earth System Integrity (Department of Environmental Affairs, 2016; Engel, 2018). The IPCC (2014) suggests that the impact of anthropogenic activity on the earth's land surface, ocean, coasts, atmosphere, biological diversity, water cycle and biogeochemical cycles are undeniable and may negatively affect the future of the ocean economy.

As the OECD (2016) report on *The Ocean Economy in 2030* emphasised, realising the full potential of the seas and ocean will demand responsible, sustainable action on numerous fronts to achieve a durable balance between ocean use and marine ecosystem integrity. Owing to the complex nature of the ocean economy, any extreme scenario associated with social, economic or environmental risk factors will have a direct effect on a society and its individuals (OECD, 2016 and UK Department of Transport, 2019). As much as environmental risk factors have the ability to cause physical damage to the ocean environment, they are becoming highly-observable and can generate intensified public reaction or even panic. In this regard, three possible wild cards can be summarised, briefly identified, that might impede South Africa's ocean economy leading up to 2060. These wild cards include:

a) Extreme population growth
b) Failure to appropriately plan for climate change
c) Over-exploitation of South African natural resources

The effects of human activity on the environment can be difficult to understand or predict. However, human activities can trigger environmental changes with severe consequences for the earth's environment and inhabitants. Key environmental parameters indicate that the earth system has moved outside the range of natural variability exhibited over the last 500 000 years with the scale of change unprecedented and posing a significant risk to the environment (IPCC, 2014). This challenge has been expressed in recent United Nations Framework Convention on Climate Change documentation (Department of Environmental Affairs, 2016; Engel, 2018).

Two widely-used indicators, which highlight the physical and chemical effects of climate change on the marine environment, are ocean warming and ocean acidification. The ocean surface generally is in a state of equilibrium with the atmosphere with respect to carbon dioxide and heat. Ocean warming leads to ice sheet melting and sea level rises. It also increases the frequency of extreme weather events such as coastal storms. This contributes to the possibility that ocean currents may be impacted, causing changes in regional climate systems. South Africa's ocean has not escaped this warming (Department of Environmental Affairs, 2016; Engel, 2018). With increasing sea surface temperatures, marine species are expected to shift their distribution patterns in response to the changing temperature regimes.

The probability of expanding the ocean economy as a basis for economic and social development is evidenced by the observation that South Africa has more ocean space, including its exclusive economic zone, than land area (Department of Environmental Affairs, 2014; Van Wyk, 2015, Walker 2018). An audit of the socio-economic value of goods and services provided by the ocean recently produced by the World Wildlife Fund, South Africa (2021) underscores the direct potential for asset development for fishing, aquaculture, coastal development, marine mining, oil and gas as well as tourism. In his 2016 State of the Nation address, (former) President Zuma identified the significance of the ocean economy for boosting economic growth and job creation as well as for addressing the triple scourges of poverty, inequality and unemployment (Department of Environmental Affairs, 2016). As South Africa is characterised by major imbalances in terms of spatial development Operation Phakisa is viewed as an initiative which will also impact spatial development imbalances as it will be used as a lever to assist development of rural economies through a number of planned interventions (Department of Environmental Affairs, 2016).

4.8 A FUTURES TRIANGLE FOR SOUTH AFRICA'S OCEAN ECONOMY TOWARDS 2060

Chapter 1 identifies the areas that are interrelated and have the highest potential to drive sustained economic growth internationally and, for the country, will form the basis for the futures triangle, the CLA and the development of scenarios for South Africa's ocean economy towards 2060. This section focuses on the futures triangle and the CLA and the scenarios is discussed in Chapter 6.

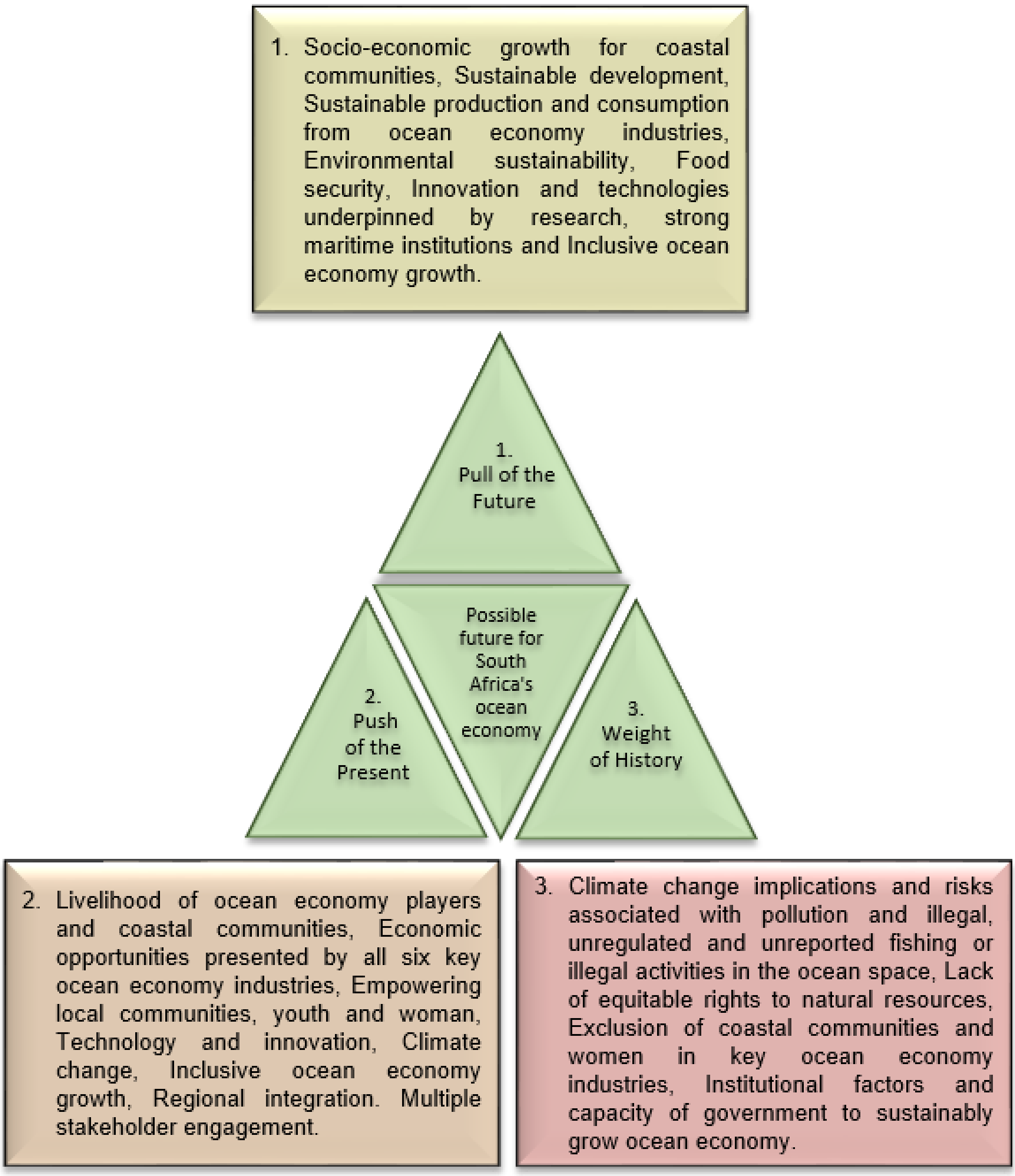
The futures triangle, is a phase which analyses the interaction between the following three forces:

a) The image of the future of the ocean economy that pulls industry players/ service providers and related stakeholders forward.
b) The pushes of the present that will have an intense impact on the ocean economy globally and in South Africa and which includes issues such as urbanisation, declining economies, climate change, pollution to the ocean and growth prospects for the ocean economy.
c) The barriers to change related to each of these future images may include perceptions in the reading of the risks associated with the ocean economy, regional and national capacities and other related institutional and regulatory factors.

In addition to the environmental scanning completed in Section 4.5, the future of the ocean economy is thus mapped through these three future triangle dimensions. The futures triangle assisted the researcher to analyse the interactions between images that promote growth in the ocean economy, drivers that have an intense impact on the ocean economy and barriers and risks associated with a sustainable ocean economy.

The futures triangle for South Africa's ocean economy towards 2060 is presented in Figure 4.6. It highlights the images of the future for South Africa's ocean economy (pull of the future), the key drivers and trends (push of the present), and the barriers to change in the assumptions about the way the ocean economy growth and sustainability around key ocean industries (weight of history) are created. By analysing the interaction between these forces, the futures triangle, presented in Figure 4.6, assisted in shaping a future for South Africa's ocean economy towards 2060 that would contribute towards socio-economic growth as well as environmental and livelihood sustainability at both global and local levels.

Figure 4.6: Futures triangle for South Africa's ocean economy towards 2060



Source: Researcher's own construction based on Inayatullah (2013) and Oberholster (2017).

By analysing the interaction between these forces, the futures triangle, presented in Figure 4.6, assisted in shaping a future for South Africa's ocean economy towards 2060. This was informed by images of the future for South Africa's ocean economy, key drivers and trends and the barriers to change in the assumptions about the way the ocean economy growth and sustainability are created. To create a desired future, it is, however, evident that there is a critical need to address research, technology and innovation in ocean economy industries and the capability of all stakeholders involved in ocean growth initiatives, including women and local communities.

4.9 SUMMARY

Chapter 4 provided and overview of the South African ocean economy, the current status and the growth areas identified for a sustainable ocean economy. It further outlined the six key sectors, namely, (i) marine transport and manufacturing, (ii) offshore oil and gas exploration (iii) aquaculture, (iv) marine protection services and governance, (v) small harbours and (vi) coastal and marine tourism, in the ocean economy. Operation Phakisa prioritised these sectors as key growth areas to contribute towards unlocking the economic potential of South Africa's oceans, based on their potential contribution to economic growth and job-creation. The STEEPLE analysis and drivers for change in the South African ocean economy were also described by showing the South African context and through the development of a futures triangle, which could possibly assist in shaping a future for South Africa's ocean economy towards 2060. In Chapter 5, the megatrends and drivers for the South African ocean economy through the real-time Delphi method are explored and confirm the identified megatrends and implications.

CHAPTER FIVE

MEGATRENDS AND DRIVERS FOR SOUTH AFRICA'S OCEAN ECONOMY THROUGH THE REAL-TIME DELPHI METHOD

5.1 INTRODUCTION

Chapter 4 presented an analysis of South Africa's ocean economy, using the environmental scanning future-research approach. A Social, Technological, Economic, Environmental, Political, Legal and Ethical (STEEPLE) environmental analysis on the South African ocean economy and a future triangle provided the basis from which the megatrends to be explored in this chapter were identified. The implications of these trends, as well as potential game-changing forces, regarding the future of South Africa's ocean economy, were also identified. This chapter presents the key elements of the real-time Delphi method, which were employed to check the future importance and probability of occurrences of the identified trends in Chapter 4 and drivers in the ocean economy. The method was applied to questions about the future, resource allocations, study designs, effective policies and decision-making. A detailed description of the process, as well as the suitability of the method for an ocean economy future study, is also presented. The chapter also presents the outcome of a real-time Delphi study as well as the megatrends and driving forces used in the construction of scenarios for South Africa's ocean economy towards 2060.

5.2 PROPOSED MEGATRENDS CHARACTERISING THE FUTURE OF THE OCEAN ECONOMY TOWARDS 2060

Megatrends are the paradigm shifts happening at the intersection of cultural, social, economic, political, technological, regulatory and market forces (The Economist, 2015). Megatrends can help businesses, governments and individuals prepare for an unpredictable future through the shared understanding of potential scenarios. According to the OECD (2018), there are five megatrends shaping Africa's integration into the global economy. Each megatrend brings opportunities and risks and has important policy implications. First, global wealth is shifting with emerging countries producing more than half of the global output (World Bank, 2018). In addition, new partnerships with Africa are increasing. Second, the new production revolution offers additional markets and different production methods but also creates obstacles for African producers. Third, the continent's population boom could create a *demographic dividend* if local economies can supply enough jobs and basic services to meet the growing demand. Fourth, rapid urbanisation is changing economic structures and posing new challenges. Fifth, many African countries need *green growth* strategies to adapt to climate change.

The concept of a megatrend was first introduced by John Nesbitt, in his book *Megatrends*, which described a megatrend as a long-term, transformational process with global reach, broad scope, and a fundamental and dramatic impact (Naisbitt, 1982; Oberholster, 2017). The Forward-Thinking Platform (2014) further define a megatrend as a large, social, economic, political, environmental or technological change that is slow to form. However, once in place, megatrends influence a wide range of activities, processes and perceptions, both in government and in society, possibly for decades. From this description, it is evident that a megatrend has different dimensions, namely, time, reach and impact. According to PricewaterhouseCoopers (PwC) (2016), each description offers a unique dimension as a megatrend can have a significant impact on business and society over a specific period of time. In summary, a megatrend is a major trend, at global or large scale. PwC (2016) summarises megatrends as macroeconomic and geostrategic forces that are shaping the world. They are factual and often backed by verifiable data. By definition, they are big and include some of society's biggest challenges as well as opportunities (PwC, 2016). For this study, a megatrend was. Therefore, described as a long-term, transformational process with global reach, broad scope as well as a fundamental and significant impact.

5.2.1 Basis for the proposed megatrends

In identifying the megatrends within the ocean economy, the 15 global challenges identified in Chapter 3 and the major drivers for the South African ocean economy as explained in Chapter 4 were important and formed the basis for the proposed megatrends. Table 5.1 incorporates the 15 global challenges, the key six ocean economy sectors and the ocean economy drivers, the premise from where the proposed megatrends were derived.

Table 5.1: Proposed megatrends incorporating the 15-global challenges, ocean economy drivers and key ocean economy sectors

Relevant global challenge from the 15 global development challenges	Driver within the ocean economy	Key ocean economy sector affected	Wild cards
Proposed Megatrend 1: Meeting future energy demands through sustainable ocean industries			
1) Meeting growing energy demands safely and efficiently 2) Balancing population growth and resources 1) Addressing global climate change and sustainable development 2) Accelerating scientific and technological breakthroughs and improved human conditions	This megatrend has an impact on the social drivers associated with population trends, namely, employment creation needed as well as the environmental driver that speaks to ensuring that alternative energy initiatives that will affect the ocean economy do not promote degradation and depletion of ocean resources. Energy resources are mainly being driven by increasing demand by a growth in population.	• Marine transport and manufacturing • Offshore oil and gas exploration • Fisheries and aquaculture • Marine protection services and governance	Social wild cards such as inequality and socio-economic disruption that could stem from the widening gap between rich and poor, inability to achieve education target for skills development, uncontrollable and rising migration patterns. Environmental wild cards of pollution through oil spills or dumping at sea.

<table>
<tr><th colspan="4">Proposed Megatrend 2: Smart population driving ocean economy development and improved social standards</th></tr>
<tr><td>1) Balancing population growth and resources</td><td rowspan="5">• Social drivers (migration patterns towards coastal cities, promoting education and training and skills development for the future)
• Technological Drivers (increasing reliance on satellites and data sharing, growing reliance on digital and autonomous systems)
• Economic drivers (employment creation)
• Political drivers (governments must adopt friendlier policies that assist with technological catch-up and the absorption of knowledge)
• Legal drivers (governance policies and legislation as well as decision-making process need to be transparent, participative)
• Ethical drivers (ensuring a sustainable ocean economy will need adequately-skilled and competent people who can champion all the key priority sectors)</td><td rowspan="5">• Marine transport and manufacturing
• Offshore oil and gas exploration
• Fisheries and aquaculture
• Marine protection services and governance
• Small harbours
• Coastal and marine tourism</td><td rowspan="5">Social wild cards such as inequality and socio-economic disruption that could stem from the widening gap between rich and poor, inability to achieve education target for skills development,
low monitoring of migration patterns. Environmental wild cards of pollution through oil spills or dumping at sea.</td></tr>
<tr><td>2) Accelerating scientific and technological breakthroughs and improved human conditions</td></tr>
<tr><td>3) Promoting ethical market economies in reducing inequality</td></tr>
<tr><td>4) Preventing transnational organised crime networks from becoming more powerful and sophisticated global enterprises</td></tr>
<tr><td>5) Providing global convergence of information and communications technologies</td></tr>
</table>

Proposed Megatrend 3: Food security and improved standards of living through technological breakthroughs			
1) Balancing population growth and resources 2) Providing policymaking and sensitivity towards global long-term perspectives 3) Accelerating scientific and technological breakthroughs and improved human conditions 4) Addressing global climate change and sustainable development 5) Promoting ethical market economies in reducing inequality 6) Preventing transnational organised crime networks from becoming more powerful and sophisticated global enterprises	• Social drivers (high rate of urbanisation or increased population trends will lead to increase economic activity and consumption levels on ocean resources, employment creation, education and training and skills development for the future) • Technological drivers (opportunities from biotechnology, growing reliance on digital and autonomous systems) • Economic drivers (investment in aquaculture, food security, processing and employment creation) • Environmental drivers (ocean environment is facing unprecedented change as a result of direct human activity and climate change) • Political drivers (governments must adopt friendlier policies that assist with technological catch-up and the absorption of knowledge) • Legal drivers (governance policies and legislation as well as decision-making process need to be transparent, participative, and accountable at all times and under legal and societal scrutiny. • Ethical drivers (ensuring a sustainable ocean economy entails protection, preservation and conservation of the ocean space so as to protect endangered ecosystems and species. So, it is critically important to ensure that adequately-skilled and competent people are allowed to champion all the key priority sectors)	• Marine transport and manufacturing • Offshore oil and gas exploration • Fisheries and aquaculture • Marine protection services and governance.	Environmental wildcard such as pollution through waste disposal into the ocean, oil spills or dumping at sea.

Proposed Megatrend 4: Resilient ocean economies with increased knowledge and labour productivity across all ocean industries			
1) Providing policymaking and sensitivity towards global long-term perspectives 2) Preventing transnational organised crime networks from becoming more powerful and sophisticated global enterprises 3) Promoting ethical market economies in reducing inequality 4) Reducing ethnic conflicts, terrorism, and the use of weapons of mass destruction through shared values and new security strategies	• Social drivers (people migrate to coastal cities as the marine environment facilitates certain activities such as fishing, industry, tourism and transportation, this directly impacts employment creation needed, education and training and skills development for the future) • Technological drivers (increasing reliance on satellites and data sharing, advances in autonomy and other technologies are expected to fundamentally change employment in some marine sectors, and create new opportunities to safely and efficiently explore, monitor and work at sea) • Economic drivers (big data analytics, digitalisation and more advanced communications will lead to better connectivity, efficiency gains and cost savings but also present risks to business continuity such as through cyberattack)	• Marine transport and manufacturing • Offshore oil and gas exploration • Fisheries and aquaculture • Marine protection services and governance • Small harbours • Coastal and marine tourism	Social wild cards such as inequality and socio-economic disruption that could stem from the widening gap between rich and poor, inability to achieve education target for skills development, low monitoring of migration patterns. Environmental wild cards of pollution through oil spills or dumping at sea.

5) Incorporating ethical considerations into global decisions	• Environmental drivers (environmental challenges will have major implications for global biodiversity, infrastructure, human health and wellbeing and the productivity of the marine economy) • Political drivers (significant economic decisions need to be made by political leaders who are not driving an agenda to achieve their own political desires) • Legal drivers (governance policies and legislation as well as decision-making process need to be transparent, participative, and accountable at all times and under legal and societal scrutiny) • Ethical drivers (ensuring a sustainable ocean economy entails protection, preservation and conservation of the ocean space so as to protect endangered ecosystems and species. So, it is critically important to ensure that adequately-skilled and competent people are allowed to champion all the key priority sectors)		

Proposed Megatrend 5: Antifragile global trade that empowers local communities, youth and women			
1) Promoting ethical market economies in reducing inequality	• Social drivers (migration patterns towards coastal cities, promoting education and training and skills development for the future) • Technological drivers (increasing reliance on satellites and data sharing, growing reliance on digital and autonomous systems) • Economic drivers (employment creation • Political drivers (governments must adopt friendlier policies that assist with technological catch-up and the absorption of knowledge) • Legal drivers (governance policies and legislation as well as decision-making process need to be transparent, participative) • Ethical drivers (ensuring a sustainable ocean economy will need adequately-skilled and competent people who can champion all the key priority sectors)	• Marine transport and manufacturing • Offshore oil and gas exploration • Marine protection services and governance • Small harbours	Economic wild cards such global economic recessions and geo-economic formations (i.e. BRICS, BREXIT). Ethical wild cards such as corruption and theft in ocean related economies and governance structures. Social wild cards such as inequality and an increasing dropout rate in the education system from the youth, reliance on drugs.
2) Providing policymaking and sensitivity towards global long-term perspectives			
3) Accelerating scientific and technological breakthroughs and improved human conditions			
4) Improving the capacity to decide as the nature of work and institutions change			
5) Reducing ethnic conflicts, terrorism, and the use of weapons of mass destruction through shared values and new security strategies			

Proposed Megatrend 6: Economic impact of disease events (COVID-19)			
• Reducing threat of new and re-emerging diseases and immune microorganisms • Balancing population growth and resources • Accelerating scientific and technological breakthroughs and improved human conditions • Sufficient clean water without conflict	• Social drivers (increase migration patterns and highly dense urban areas especially, this directly impacts employment creation needed, education and training and skills development for the future) • Technological drivers (increasing reliance on satellites and data sharing, Advances in Artificial Intelligence, robotics and other technologies are expected to fundamentally change employment in some marine sectors and create new opportunities to safely and efficiently explore, alternative work situations or solutions) • Technological driver (linked to an environmental driver is the new or remote world of work which reduces carbon emission from travelling and positively impacting the environment) • Economic drivers (big data analytics, digitalisation and more advanced communications will lead to better connectivity and prompt communication on disease events and solutions)	• Marine transport and manufacturing • Offshore oil and gas exploration • Fisheries and aquaculture • Marine protection services and governance • Small harbours • Coastal and marine tourism	Social wild cards such as inequality and socio-economic disruption that could stem from the widening gap between rich and poor, inability to achieve education target for skills development, low monitoring of migration patterns. Environmental wild cards of pollution through oil spills or dumping at sea. Economic wild cards could be a reduced productive workforce due to economies not being able to afford vaccination or improved health standards.

Source: Researcher's own construction.

5.2.1.1 Proposed Megatrend 1: Meeting future energy demands through sustainable ocean industries

By adopting the concept of a sustainable ocean economy and developing more coherent, integrated, fair and evidence-based approaches to managing the economic development of the ocean, leaders stand to alleviate one of their defining obstacles to sustainable development, namely, a narrow resource base. According to the OECD (2020a), 37% of South Africans do not have access to reliable water supply and 20% do not have access to sanitation, resulting in water pollution and adverse health impacts. A sustainable ocean economy approach offers the prospect of sustained, environmentally-sound, socially-inclusive economic growth, as well as fostering innovation. Moreover, a path towards a sustainable ocean economy also incorporates and builds strategies that are important to not only address SDG14, but to contribute to meeting targets on at least nine other SDGs. The ability for countries to meet growing energy demands safely and efficiently through sustainable water provision, mechanical and thermal ocean energy industries remain key for a thriving ocean economy.

5.2.1.2 Proposed Megatrend 2: Smart population driving ocean economy development and improved social standards

Ocean innovations in the pipeline, especially those building on generic advances in science (for example, biochemistry, physics) and technology (for example, artificial intelligence, robotics, big data), appear set to enhance knowledge and understanding of marine ecosystems and their functions and improve ocean industries' performance markedly (OECD, 2019). With coastal cities becoming more urbanised and technologically-advanced, ocean industries will be led by people that are advanced in science and technology promoting ocean economy development and improving the lives of citizens through technology and integrated platforms. The advances in science and technology are not only crucial for growing the innovation, research and skills within coastal communities but also key in putting the specific maritime nation on the map and improved social standards. This has a direct impact on the standards of living and possible attraction of investors as well as promoting tourism within coastal areas.

Without exploring and going into detail on economic analysis that considers ocean economy inputs and outputs to provide an aggregation of ocean industries and the various forward and backward linkages, this megatrend is related to labour productivity and increased knowledge across all ocean industries especially those within smaller coastal cities and have huge potential for small harbours development. With reduced social challenges (namely, population densities in coastal areas, improved education levels and less cultural clashes) increased knowledge and labour productivity levels will assist in growing the ocean economy**.**

5.2.1.3 Proposed Megatrend 3: Food security and improved quality of living through technological breakthroughs

Fisheries and aquaculture provide an important source of animal protein for human consumption (FAO, 2014). According to the World Bank (2013), global population is expected to reach nine billion by 2050, and the world food-producing sector must secure food and nutrition for the growing population through increased production and reduced waste. With rapidly expanding aquaculture production around the world, there is a large potential of further and rapid increases in fish supply (World Bank, 2013; OECD, 2016; WWF-SA, 2018). During the last three decades, capture fisheries production increased from 69 million to 93 million tons, and during the same time, world aquaculture production increased from five million to 63 million tons (Fish Stat, 2013). Globally, fish currently represents about 16.6% of animal protein supply and 6.5% of all protein for human consumption (FAO 2017). Fish is usually low in saturated fats, carbohydrates, and cholesterol and provides not only high-value protein but also a wide range of essential micronutrients, including various vitamins, minerals, and polyunsaturated omega-3 fatty acids (FAO, 2017). Thus, even in small quantities, provision of fish can be effective in addressing food and nutritional security among the poor and vulnerable populations around the globe.

5.2.1.4 Proposed Megatrend 4: Resilient ocean economies with increased knowledge and labour productivity across all ocean industries

Disease preparedness and prevention will reduce the impact epidemics have on people's health and livelihoods far beyond the direct effects of the outbreak in the sectors of the countries where the disease occurs. The impacts of the COVID-19 pandemic make the need for resolute ocean action from the development community more pressing. Entire ocean-based sectors such as tourism, sea transport and many others are being disrupted, with major economic consequences for developing countries (World Bank, 2020). While it is too early to know the full impact of the pandemic, the needs of the post-crisis recovery will certainly vary across countries and recovery efforts will have to be country-led. Development co-operation needs to be in line with countries' national priorities and strategies for the emergency response and the recovery. It will need to concentrate not only on helping to address the health emergency, but also on *building back bluer* and fostering a recovery that puts ocean-based sectors solidly on a track of environmental and social sustainability. With reduced social challenges (namely, population densities in coastal areas, improved education levels and communicable diseases), this will assist in growing the ocean economy and promoting resilient economies that can survive after an economic crisis as it happened in 2009 with the global economic crisis and with the COVID-19 pandemic.

5.2.1.5 Proposed Megatrend 5: Antifragile global trade that empowers local communities, youth and woman

A human-made waterway, the Suez Canal is one of the world's most heavily used shipping lanes, carrying over 12% of world trade by volume and, in 2021, it was not expected that an error made by a large container ship would cause disruptions in global trade. In 1955, traffic through the Suez Canal accounted for about 13%, in volume, of world seaborne crude tanker cargo alone accounted for approximately 8% of the total volume of international trade and 19% of all cargo carried by tankers (UN Headquarters the Economic Weekly, 1957). It is estimated that it costs probably $600 million more per year to carry the same cargo around the Cape of Good Hope and that about half of that extra cost would be needed to transport crude oil from the Middle East to Western Europe and North America with the present facilities (UN Headquarters the Economic Weekly, 1957). Global trade and geographical positioning along key transport routes is a key feature for development and developing countries as it highly correlates with various key sectors and exposes countries and coastal nations to global economic activity (UNCTAD, 2020a). An increased level of involvement of local communities, youth and women in the design and implementation of sustainable ocean economy growth solutions has an impact on the demand for manufactured exports and tourism services of foreign investment inflows, and lower worker remittances.

5.2.1.6 Proposed Megatrend 6: Economic impact of diseases (COVID-19)

During World War II, many fishing vessels were forced to stop fishing. This reprieve allowed fish populations, such as cod, to increase. This shows that living ocean resources literally grow during downturns as it has been experienced with many countries implementing lockdown. Lockdowns and reduced demand for seafood have seen fishing activity fall by as much as 80% in China and West Africa (World Economic Forum, 2020). Should any such gains accrue during COVID-19, the urge to immediately over-harvest them should be resisted. Instead, fisheries science should be used to design intelligent harvest-yield protocols that maximise the long-term benefit of any possible COVID-19 gains. UNCTAD (2020b) further reported on COVID-19-associated drops in activity around shipping, of up to 30% in some regions. Entire nations dependent on ocean and beach-associated tourism have shut their borders and, globally, COVID-19's impact on tourism may amount to a $7.4 billion loss and could put 75 million jobs at risk UNCTAD (2020b). Towards 2060, South Africa will be better prepared in disease management and prevention, which will assist in reducing the impact epidemics have on people's health and livelihoods far beyond the direct effects of the outbreak in the sectors of the countries where the disease occurs, thus, reducing the economic and social impact of disease events for the ocean economy, which is a global industry.

5.3 REAL-TIME DELPHI RESEARCH METHOD

The Delphi method is a social research technique, which seeks to obtain a reliable group opinion from a set of experts. The method is used most adequately in situations of high uncertainty that require a mixture of scientific evidence and social perception (Linstone & Turoff, 2011; Grisham, 2009; Gordon, 2009). In applying the Delphi technique, the researcher provided an anonymous and structured group communication process that allowed experts to effectively deal with the complexity of the research on the future of the ocean economy towards 2060 (Linstone & Turoff, 2011). Delphi has been used since the sixties in academic and business spheres and has been employed principally as a technique for planning and consensus in uncertainty situations in which it is not possible to use other techniques based on objective information (Rowe & Wright, 1999, 2001). The Delphi is a group facilitation technique that seeks to obtain consensus on the opinions of *experts* through a series of structured questionnaires (commonly referred to as rounds). Hasson, Keeney and McKenna (2000) once again highlight that questionnaires are completed anonymously by these experts (commonly referred to as the panellists, participants or participants in other research studies). As a part of the process, the responses from each questionnaire are fed back in summarised form to the participants. The Delphi is, therefore, an iterative multistage process designed to combine opinion into group consensus (Hasson et al, 2000).

For Rowe and Wright (1999), the introduction of the real-time Delphi allowed for more flexibility and simplicity, which has led to its successful application in different geographical and thematic contexts.

The main characteristics of the Delphi method include that it:

- is an iterative process,
- keeps the anonymity of the participants, or at least that of their replies, as these go directly to the coordinating group,
- is controlled feedback,
- is a statistical group response, namely, all the opinions form part of the final reply.

Delphi is a method that requires knowledgeable and expert contributors to individually respond to questions through a repeated interview or questionnaire who then submit the results directly to the coordinator who would process the answers looking for central tendencies and their rationales (Gordon, 2009). The classic Delphi technique was first developed by the RAND Corporation in the US (Gordon, 2009). Their goal was to overcome some of the weaknesses that group studies often suffered from, for example, the *bandwagon* effect, where group members follow the lead of the majority, or the *halo* effect, where group members follow the lead of someone who they think is the most knowledgeable expert. Instead, they wanted to systematically develop expert opinion consensus about future developments and events.

Four key features that need to be adhered to in the Delphi procedure are the anonymity of Delphi panels, iteration that allows panellists to refine their views, controlled feedback and statistical aggregation of group response that allows for quantitative analysis and the interpretation of data (Rowe & Wright, 1999). Hasson et al (2000) also confirm that the usual Delphi forecasting procedure takes place in the form of an anonymous, written, multi-stage survey process, where feedback of group opinion is provided after each round. The simplest, most generalisable definition is offered by the RAND Corporation that originally defined Delphi as a method for "eliciting and refining group judgments" (Grime & Wright, 2011). Given a more in-depth look into the purpose of the technique, illustrates that the employment of the Delphi method is for facilitating structured group communication to gather a consensus of expert opinions in the face of complex problems, expensive endeavours, and uncertain outcomes. The principles of the method are that more minds are better than a single mind, and, when used as a forecasting tool, that structured group efforts lead to more accurate forecasts than unstructured. Delphi is designed as an internet based, almost real-time survey and offers more advantages/strengths versus the identified limitations/weaknesses. These advantages and limitations are summarised in Table 5.2. The use of an internet survey in the form of a real-time Delphi will provide immediate feedback that streamlines the classical procedure (Gordon, 2009; Markmann, et al, 2013). The real-time Delphi research process is more interesting and convenient for the surveyed experts, who can see data trends immediately. Using this technique also allowed the researcher to automate much of the data analysis.

Table 5.2: Comparison of advantages / strengths versus limitations / weaknesses of the Delphi method

Advantages / Strengths	Limitations / Weaknesses
1. Consensus-building	Group pressure for consensus, may not be true consensus
2. Future forecasting	Feedback mechanism may lead to conformity rather than consensus
3. Bring geographically dispersed panel experts together, overcoming spatial limitations	No accepted guidelines for determining consensus, sample size and sampling techniques
4. Anonymity and confidentiality of responses	Outcomes are perceptual at best
5. Limited time required for participants to complete surveys	Requires time/participant commitment
6. Quiet, thoughtful consideration	Possible problems in developing initial questionnaire to start the process
7. Avoids direct confrontation of experts with one another (encourages honest opinion, free from group pressure)	May lead to hasty, ill-considered judgements
8. Structured/organised group communication process	Requires skill in written communication
9. Decreasing somewhat a tendency to follow the leader	Potential danger of bias, surveys are open to manipulation by researchers
10. Focused, avoids unnecessary side-tracking for panelists	Selection criteria for panel composition
11. Ties together the collective wisdom of participants	Time delays between rounds in data collection process
12. Cost effective and flexible/adaptable	May force a middle-of-the-road consensus
13. Validity, as the content is driven by panelists	Concerns about the reliability of the technique
14. Fairly simple to use	Drop-outs, poor response rates
15. Beneficial for long-range educational planning and short-term decision making	
16. Applicable where there is uncertainty or imperfect knowledge, providing data where little exists before	
17. Effectively used to establish the basis for future studies	
18. Accommodates a moderately large group	

Source: Hung et al (2008).

Table 5.2 lists the 18 advantages/ strengths versus the 14 identified limitations/weaknesses and these advantages and limitations of using a real-time Delphi data collection tool. Of the advantages listed, a structured/organised group communication process, limited time required for participants to complete surveys and anonymity and confidentiality of responses is very important in promoting ethical research as identified in Chapter 2. With the identified limitations of weaknesses, a clear definition of the selection criteria and a good preparation in developing initial questionnaire to start the process were key in limiting possible problems in research.

5.3.1 Real-time Delphi panel

The objective of Delphi studies is not to obtain a representative sample of a population, as with most conventional surveys. Rather, Delphi research aims for a high inclusion of expertise. Participants are seen to be eligible to participate in a Delphi study if they have an educational background in the specific topic or if they have relevant experience in the related field of study (Hsu & Sandford, 2008; Oberholster, 2017; Schuckmann, Gnatzy, Darkow and Heiko, 2012). It is important, as best possible, to include representation from a variety of stakeholder groups (Oberholster, 2017). Rowe and Wright (2011) suggest that it is beneficial to include a mix of experts and laypeople to encourage heterogeneity. The key to a successful Delphi study lies in the selection of participants, and this is also the key in real-time Delphi since the results of a Delphi depend on the knowledge and cooperation of the panellists (Gordon, 2009).

Rowe and Wright (2001) summarise the following principles for using expert opinion in applications of Delphi:

- Use experts with appropriate domain knowledge,
- Use heterogeneous experts,
- Use between five and 20 experts,
- Provide the mean or median estimate of the panel plus the rationales from all panellists for their estimates for Delphi feedback,
- Continue Delphi polling until the responses show stability. Generally, three structured rounds are enough,
- Obtain the final forecast by weighting all the expert estimates equally and aggregating them.

5.3.2 Real-time Delphi study

The real-time Delphi system employs a generic form of the questionnaire that is used in all studies. It is moulded into specific forms that support particular studies through the use of three other forms. These forms include a specifications loader that contains information such as the number of rows and columns and the study's completion date, a question loader that lists the questions and references that are specific to the questions, and a master that specifies information such as the administrator's code (for security), and the logo to be employed (The Millennium Project, 2015). When carrying out a Delphi study, the technique usually is applied over several rounds until the pre-defined, stopping criteria are attained or when consensus is achieved (Oberholster, 2017; Schuckmann et al, 2012).

While a traditional Delphi study can range between two and ten rounds, a real-time Delphi study only needs one round (Gordon, 2009). In line with the real-time Delphi structure, only one round was applied during the course of this study. Participants, however, had the ability to enter, leave and re-enter the study at any time during the course of the study period. The real-time Delphi ran for a period of four weeks and closed as well as open-ended questions were used to get insights on certain megatrends, key drivers or enablers and wild cards, which might define the future of a sustainable ocean economy for South Africa. The closed questions were translated into the quantitative aspect of the research, in this instance. the researcher gathered data by measuring variables in numerical format and represented the data in a table format. The open-ended questions were used to gain insight, provoke and reflect on the participants input and add quality to the qualitative aspect of research.

5.3.2.1 Pilot study

The real-time study was prepared using the eDelphi platform and a pilot was conducted for a period of one week as the researcher was not familiar with the platform and needed to the test the accessibility, appearance and interactiveness of the platform. The pilot assisted with confirming the system's compatibility and it also confirmed that the software supported Microsoft Edge, Firefox and Google Chrome browsers. The pilot also confirmed the actual time needed to complete both the closed and open-ended questionnaire sections. The eDelphi study consisted of four parts.

Part 1 consisted of seven closed questions on demographic information. Part 2 identified/proposed six megatrends that had and continued to shape the ocean economy through a mixture of closed- and open-ended questions and supporting statements for the identified megatrends and decisions on the formulated megatrend. Part 3 consisted of seven of key enablers or drivers that shaped the future of the ocean economy, and Part 4 consisted of seven wild cards that had and continued to shape the future of the ocean economy towards 2060, which was also conducted through closed questions. The pilot was also important in timing the actual study and it was confirmed that participants need a total time of approximately 80 minutes to complete and to further ensure that they used a supported internet browser (namely, Microsoft Edge, Firefox and Google Chrome).

5.3.2.2 Actual Delphi study

The study was initially launched to a total number of 36 purposively-sampled experts in the ocean economy, located in South Africa, East Africa, Europe, America, Middle East and Asia. The study applied a key feature of the real-time Delphi study of "having only one round" (Gordon, 2009:6), which was kept running for a period of four weeks, during which the participants were reminded fortnightly via e-mails on the developments made with the study and to encourage them to revisit the questionnaire to enhance the exchange of information during the extended round. Owing to the low response rate at the end of the anticipated timeframe, the study was extended for another week making the total running period five weeks.

In this study, experts in the field of ocean economy development and research were approached and invited to participate in the real-time Delphi panel. Gordon (1994) emphasises that the size of the panel does not necessarily equate to better results, and that no such causal relationship exists which could influence the validity and reliability of the final consensus. The participants received a link via email to the real time-Delphi platform and the questions and information shared via the platform are attached as Appendix 2. The demographics of the sample is portrayed in Table 5.3, which shows a total number of 12 experts that participated in the study mainly operating in the South African and the Middle East regions. Participants from other regions (Asia, South America and Europe) were also invited to the panel and declined the invitation without providing any reasons.

Table 5.3: Real-time Delphi Demographics summary of expert sample

Operating region (s)		Education background or field of study		Years of experience in the ocean economy	
Middle East	1	Natural Science	6	1-3 years	1
South Africa	10	Business, Finance and Economics	1	3-5 years	3
Other: SADC	1	Construction / Built Environment	0	6-10 years	3
		Engineering (Mechanical, Civil and Computer Science)	0	10-15 years	1
		Arts and Humanities	1	15-20 years	2
		Law	0	20-30 years	1
		Other: Port Logistics and Transport	4	Other: 50 years	1
Total	**12**		**12**		**12**

Source: Researcher's own construction,

The structure of the real-time Delphi study was set out and kept in line with the guidelines presented by Gordon (2009):

a) A panel of experts were requested to participate in the study, with desired feedback from a minimum of ten participants on the future of South Africa's ocean economy towards 2060. The criteria for inclusion in the study was knowledge and involvement, either on a research and training capacity or from an ocean economy business and operations perspective within the ocean economy. Participants came from business practitioners, researchers and decision-makers that had been involved in the ocean economy for more than a year and they could be based anywhere in the world.

b) The study was also open to experts and futurists part of the real-time or eDelphi platform and they were also requested to participate provided they had knowledge, expertise and experience in any of the ocean economy industries. These experts were contacted and were requested to participate.

c) Van Vuuren (2002) notes that it is acceptable and common practice to use structured questions that are based upon an extensive review of the literature. As a result, the questions used were set up in such a manner using the literature review covered in Chapters 3 and 4.

d) In accordance with Gordon (2009), the use of an online web-based platform to facilitate the study provides numerical estimate of the priority of each question based on a Likert scale. The Likert scale was coded such that the smallest number was the least feasible/desirable constituent and the highest number applied to the most feasible/desirable driving force.

e) On-going feedback was provided to the participants concerning the average of all the responses of the group, the number of responses made, and the reasoning provided for responses by other participants.

f) Finally, there was a section that allowed participants to provide their own reasoning for the thought behind their answers.

g) Participants of the study received guidelines as well as consolidated feedback on the results so as to ensure that the study was undertaken in a transparent and ethical manner.

The answers and feedback to the questions and statements in the real-time Delphi formed key driving forces that would serve as the scenario inputs and assist the researcher with developing a vision for South Africa's ocean economy towards 2060. As highlighted in Chapter 1, the research made use of a sequential mixed research method approach that was predominantly qualitative. The researcher also mainly used a qualitative analysis that was heavily dependent on the researcher's analytic and integrative skills as well as personal knowledge of the data collection's social context. The emphasis in the predominantly qualitative analysis was *sense-making* or understanding a phenomenon, rather than predicting or aiming to generalise the results for ocean economy countries.

Gordon (2009) notes that the real-time Delphi technique specifically assists with:

- Validating the driving forces as applicable,
- Reformulating driving forces according to responses,
- Casting doubt on any driving force and/or identifying any contrary interpretation,
- Identifying implications and adding insight into the future impact of the driving forces,
- Identifying possible wild cards which could fundamentally influence future outcomes,
- Identifying new ideas that have not been focused on during the environmental study.

The results of the study were consolidated and used as a guide in developing scenarios, with expert opinion on driving forces that were likely to be feasible and desirable as opposed to what was not likely to be feasible and desirable. The results, coupled with the responses from the semi-structured interviews assisted in prioritising the driving forces highlighted and substantiating their inclusion in the developed scenarios.

5.4 REAL-TIME DEPHI PROCESS AND DATA ANALYSIS

Given that the participants interpretation and comprehension of the formulated megatrends, key enablers and wild cards might vary based on their own worldview, and their varying contextual settings, the results of the Delphi study needed to be examined for relevancy and plausibility (Gordon, 2009). Analysing the data received from participants in the study, panel members were requested to study the responses from the group, to evaluate their own position based thereon, and to provide a rationale for each megatrend, key enabler or drivers and wild cards, for responses that varied significantly from that of the group norm (Hasson et al 2000). The literature review and data analysis for this research was supported by an in-depth environmental scan, from which the megatrends were identified as highlighted in Section 5.2.1.

5.4.1 Data collection process

A Delphi study can be conducted through a variety of different media such as pen-and-paper, telephones, faxes and electronic mail (Day & Bobeva, 2005). As highlighted in Chapters 1 and 2, the study made use of the conventional real-time Delphi or eDelphi, which is an electronic communication technology that is recognised as an emerging research tool that also provides the benefit of full anonymity for the participants and prevents group-thinking, which also enables an efficient and swift exchange of information to an entire population without the need to incur costs in bringing a group of experts together to a single location (Young & Jamieson, 2001). A total number of 36 respondents were purposively sampled owing to their knowledge and involvement, either on a research and training capacity or from an ocean economy business and operations perspective as well as ocean governance. Only one round was applied in this research, from which several computations were executed as part of the real-time Delphi process. A summary of the eDelphi data collection process is presented in Table 5.4.

Table 5.4: eDelphi design for the development of scenarios for South Africa's ocean economy towards 2060

Criteria	Choice
Purpose of the study	To validate and provide insight into megatrend key enablers and wild cards for South Africa's ocean economy towards 2060.
Participants	The study targeted a mixed group of 36 experts internationally and in South Africa who had knowledge and insight into the ocean economy. Twelve experts/participants took part in the study and of the 12 participants, ten fully completed Parts 1, 2 3 and 4 of the questionnaire and optimally-used the iterative nature of the real-time Delphi platform.
Process	Remote electronic access
Anonymity of panel	Full anonymity
Communication media	Computerised on eDelphi.org via the Global Future Studies platform

Source: Researcher's own construction, adapted from Day and Bobeva (2005:104-105).

5.4.2 eDelphi questionnaire

The questionnaire consisted of four queries or parts to allow for the participants to complete one section and return for the other sections when time allowed. This was implemented after the pilot took approximately 80 minutes to complete, and it would have been unreasonable to expect experts to spend that amount of time at one go. Part 1 consisted of six closed questions on demographic information. Part 2 proposed six megatrends each with two closed questions on the importance and probability of the megatrend, one open-ended question on the decision on the megatrend and four to five supporting statements formulated as closed- and open-ended questions as guided by the environmental scanning process conducted in Chapter 4. Parts 3 and 4 both consisted of seven closed questions each and seven open-ended questions for impact comments based on the selection made. In total, the ten participants from the real-time Delphi process cumulatively provided insight into 103 questions. Of the 103 questions, a total of 64 worded statements or closed questions, linked to the demographic information of the participants, identified megatrends, key enablers and wild cards for South Africa's ocean economy were developed, which provided the basis for the quantitative analysis and 39 open-ended questions, which provided the basis for the qualitative analysis, attached to this study as Appendix 2. All closed questions in the study used a Likert scale of 1-5, where a score of 1 indicated the least importance or low probability of occurrence, while a 5 indicated most importance or high probability of occurrence. According to Welman and Kruger (2001), the Likert scale is simple to measure and is based on participants assumptions, relationships and attitudes to each item.

5.4.3 Criteria for inclusion and how it links to reliability and validity in the study

As highlighted in Chapter 2, reliability and validity are conceptualised as trustworthiness, rigor and quality in a predominantly qualitative paradigm. Hasson et al (2000) further cite that reliability and validity is key to any research study, where reliability refers to the ability to produce similar results at all times under constant conditions, and that it is less likely for several experts in a field to arrive at a wrong decision than that of a single individual. As highlighted in Section 5.4.1, the experts/participants invited in the study were purposively sampled owing to their knowledge and involvement, either on a research and training capacity or from an ocean economy business and operations perspective within the ocean economy. Hsu and Sandford (2008) and Campos-Climent et al (2012) suggest the use of the median to measure the degree of consensus amongst the participants. According to Hsu and Sandford (2008), the measures of central tendency (means, median and mode) and the level of dispersion (standard deviation and inter-quartile range) are the most frequently used statistical analysis in eDelphi studies to present information concerning the collective judgments of the participants. The median, is described as the midpoint of the values. after they have been ordered, from the smallest to the largest, or the largest to the smallest. This was also used in this research study to measure the degree of consensus. Subsequently, a median Likert score was calculated for each megatrend and driving force in terms of its importance and probability of occurrence.

5.4.4 Confirming megatrend for South Africa's ocean economy through the eDelphi study

This section presents a summary of the comments gained from the eDelphi process in this research. It reflects an analysis of key arguments on the importance, and the probability of occurrence, of each of the identified six megatrends. Thereafter, Sections 5.4.5 and 5.4.6 expand on the key enablers or driving forces and wild cards that have and continue to shape the future of South Africa's ocean economy towards 2060 and how these results informed a futures triangle for South Africa's ocean economy towards 2060.

5.4.4.1 Megatrend 1: Meeting future energy demands through sustainable ocean industries

Table 5.5 presents the feedback and decision regarding megatrend 1. Participants reached consensus in terms of the importance thereof and confirmed that alternative energy sources remain key for South Africa, not only for the future, but immediately as reliable energy impacts on economic development and job creation. If South Africa, towards 2060, wanted to be able to meet the growing energy demands safely and efficiently through sustainable mechanical and thermal ocean energy industries, the country needed to be innovative and use all possible means to significantly change the economic landscape. This development was vital, if the country wished to remain relevant. The emergence of jobs that did not even exist at the moment on future energy initiatives would require a bouquet of specialised vocational skills, including tech savviness, brain power skills such as complex problem-solving, cognitive flexibility, critical thinking, creativity, accurate judgement and decision-making as well as soft skills such as emotional intelligence were of utmost importance. This implied that the need to develop durable skills for this megatrend to continue was confirmed. Table 5.5 illustrates the evaluation of megatrend 1 and its implications for South Africa's ocean economy toward 2060.

Table 5.5: Evaluating megatrend 1 and implications for South Africa's ocean economy towards 2060

Megatrend 1: Meeting future energy demands through sustainable ocean industries				
Megatrend 1	Collective Likert score (importance of the megatrend)	4.0	Collective Likert score (probability of occurrence)	3.0
Decision on Megatrend 1	Keep the formulation (Average score 9 /10 = 90%) *Towards 2060, South Africa would be able to meet growing energy demands safely and efficiently through sustainable mechanical and thermal ocean energy industries.			

Source: Researcher's own construction.

The feedback and decision on megatrend 1 as highlighted in Table 5.5 emphasised the importance of using alternative energy sources from sustainable ocean industries to meet the future energy demands for South Africa. In analysing the supporting statement that looked at the South African regulatory (taking into consideration current policies and legislation) environment stimulating such a trend, six out of the ten participants selected the negative (NO) stating that, when it came to strategies to deal with meeting future energy demands, the participants stated that South Africa had competing views, which in the main were clouded by politics and this made things difficult to predict precisely as to what would be happening in South Africa's energy industry in the future.

The second support statement looked at the growth in the South African population driving the increasing demand for energy resources necessitating the country to explore sustainable ocean energy resources in stimulating such a trend. Of the ten participants, nine selected a positive (YES) response and emphasised the importance of meeting future demands and facilitating growth and job opportunities as there were not enough landside opportunities to create employment. The participants further cited the importance of leveraging the various opportunities presented by the Blue Ocean economy as this was the main potential area of growth and job creation. The third support statement looked at environmental drivers and programmes in South Africa that would ensure that alternative energy initiatives did not negatively affect the ocean economy leading towards the degradation and depletion of ocean resources in stimulating such a trend. Of the ten participants, nine selected a positive (YES) response and emphasised that the environment was an essential aspect that must not merely be confined to the ocean. Education, innovation and disciplines were also key on the landside, to prevent plastic and paper from being blown into the sea. The fourth and last support statement for megatrend 1 looked at economic drivers associated with increased investments and innovative, yet affordable energy initiatives in South Africa that would stimulate such a trend. Of the ten participants, eight selected a positive (YES) response and emphasised that energy was a factor in the locational decision by investors, therefore, focusing on alternative energy resources would positively impact Foreign Direct Investments, more especially, in sectors like steel manufacturing that were heavy on energy.

5.4.4.2 Megatrend 2: Smart population driving ocean economy development and improved social standards

Table 5.6 presents the feedback and decision regarding megatrend 2. In presenting the megatrend to the participants, the researcher defined smart population as people or a population that is advanced in science and technologies promoting ocean economy development and improving the lives of citizens through ICT and integrated ocean industry platforms. Participants reached consensus in terms of the importance thereof and confirmed that technology was important for South Africa as the world was becoming more technologically-advanced and South Africa was moving towards being a technologically-friendly country. Within the ocean economy, technological advancement provided a competitive advantage as it impacted on the efficiencies that were key for investment decisions. If South Africa, towards 2060, wanted to be able to have a smart population, the educational system needed to underpin or support the genesis of a smart population through enhanced and amplified STEM and post-school innovation projects. The participants concluded that the world had advanced in technology and the advent of the COVID-19 pandemic had forced industries, and the global community to enhance their skills. In the future, most industries would be technologically-driven, and with South African population and maritime industry still attempting to catch up to their global counterparts, a lot of investment in digitisation was essential. Table 5.6 illustrates the evaluation of megatrend 2 and its implications for South Africa's ocean economy towards 2060.

Table 5.6: Evaluating megatrend 2 and implications for South Africa's ocean economy towards 2060

Megatrend 2: Smart population driving ocean economy development and improved social standards				
Megatrend 2	Collective Likert score (importance of the megatrend)	5.0	Collective Likert score (probability of occurrence)	2.5
Decision on Megatrend 2	Keep the formulation (Average score 9 /10 =90%) *Towards 2060, South Africa would have a smart population driving ocean economy development and improved social standards.			

Source: Researcher's own construction.

The feedback and decision on megatrend 2 as highlighted in Table 5.6 emphasised the importance of promoting science and technology together with educating all citizens about the value of oceans in day-to-day operations within South Africa. In analysing the supporting statement that considered the South African regulatory (taking into consideration current policies and legislation) environment stimulating such a trend, six out of the ten participants selected the positive (YES) citing that clear policies still needed to be developed and implemented. These policies needed to cater for bridging the gap between the rich and the poor. Current policies favoured the advantaged and the ocean economy was difficult for average South Africans to venture in. The second support statement considered ocean economy industries and role-players within South Africa innovating and increasing initiatives towards technological catch-up, and the absorption of knowledge on sustainable ocean economies in stimulating such a trend. Of the ten participants, nine selected a positive (YES) response and emphasised the importance of partnerships with government and all key role-players and allowing industries more freedom to tap into the various opportunities presented by the ocean economy.

The third support statement considered migration patterns towards coastal cities and the increased need to promote education and training on the ocean economy and improved skills development for the future in stimulating such a trend. Of the ten participants, nine selected a positive (YES) response, and emphasised that more skills development programmes were required in the coastal regions, but the looming challenge was having a skilled population within the coastal regions without opportunities to tap into. A concerted effort to provide knowledge and awareness about the ocean's contribution to livelihoods across the country, both for coastal and inland areas. The fourth support statement considered economic drivers associated with increased investment on technology and skills development initiatives in South Africa stimulating such a trend. Of the ten participants, nine selected a positive (YES) response and emphasised that skills development and investment into innovative technology certainly played a crucial part in developing this megatrend. The fifth and last support statement for megatrend 2 considered ethical drivers in South Africa associated with reduced corruption and adequately-skilled and competent people championing the ocean economy, stimulating such a trend. Of the ten participants, seven selected a positive (YES) response and emphasised that unethical behaviour, namely, corruption, was a pandemic in South Africa, and the government needed to move towards curbing corruption to realise investment opportunities as corruption have a negative outlook and might deter the country form achieving this trend.

5.4.4.3 Megatrend 3: Food security and improved standards of living through technological breakthroughs

Table 5.7 presents the feedback and decision regarding megatrend 3. Participants reached consensus in terms of the importance thereof and confirmed that food security and improved standards of living were crucial for where SA finds itself, currently, namely, poverty and unemployment were rife. Despite the probability of occurrence Likert scale score of 3, the participants cited that food security was key and the country needed to make better use of technology, skills and knowledge available in leveraging off the ocean economy. If South Africa, towards 2060, wanted to be able to promote food security, the technological advancements would assist in maintaining the sustainable oceans. Participants highlighted the importance of research and development (R&D) when assessing the decision on the megatrend, which had allegedly been neglected by the private sector as large corporates bought back shares instead. This had resulted in start-ups filling the gap who were then bought out by these large corporates at a later stage to use the R&D. This would, therefore, ensure sustainable food security and ocean resources. Fish farming at a larger scale would create empowerment opportunities and result into sufficient supply of fish stocks or resources from the ocean.

Table 5.7: Evaluating megatrend 3 and implications for South Africa's ocean economy towards 2060

Megatrend 3: Food security and improved standards of living through technological breakthroughs				
Megatrend 3	Collective Likert score (importance of the megatrend)	5.0	Collective Likert score (probability of occurrence)	3.0
Decision on Megatrend 3	Keep the formulation (Average score 9 /10 =90%) * Towards 2060, Technological breakthroughs in South Africa would promote food security, sustainable extraction and consumption levels on ocean resources and improved standards of living.			

Source: Researcher's own construction.

The feedback and decision on megatrend 3 as highlighted in Table 5.7 emphasised the importance of promoting technological breakthroughs in South Africa that would promote food security, sustainable extraction and consumption levels on ocean resources and improved standards of living. In analysing the supporting statement that considered the South African regulatory (taking into consideration current policies and legislation) environment stimulating such a trend, six out of the ten participants selected the positive (YES) citing that current policies were good on paper but there was very little monitoring and evaluation. The participants further stated that having a good policy dis not automatically translate into having what the policy intended to achieve. Therefore, implementation became a critical aspect to achieve what was intended. So, implementation and monitoring of such policies were more important than just having them to stimulate this trend. The second support statement considered opportunities from biotechnology, growing reliance on digital and autonomous systems and how they could promote sustainable food sources and improve standards of living. Of the ten participants, nine selected a positive (YES) response as research had shown that there was a positive correlation between technologically-advancement and output. Participants further cited that such innovations would include genetic modification, for example, fish species resistant to diseases cultivated in a recycling aquaculture system.

The third support statement considered the high rate of urbanisation or increased population trends in South Africa and how this would lead to increased economic activities and technological breakthroughs that would stimulate demand for food from ocean resources and improved standards of living for most of the population. Of the ten participants, six selected a positive (YES) response and emphasised that awareness and education were needed as a foundation for such a trend to be realised. What participants also cited was that there were no studies or research that demonstrated if there were a direct link between urbanisation and increased economic activities and technological breakthrough. The fourth and last support statement considered increased investments in South Africa on aquaculture and food processing facilities, and how these would promote employment creation and sufficient fish/food resources from ocean resources. Of the ten participants, sight selected a positive (YES) response and emphasised that any economic activity provided a better chance for an economy to create jobs. So, aquaculture as one of the economic sectors within the ocean economy, could play a big role as a job creator. Participants also highlighted that this might assist for a small percentage of the population in coastal cities, as the country only had a certain number of natural resources, therefore, other interventions were necessary.

5.4.4.4 Megatrend 4: Resilient ocean economies with increased knowledge and labour productivity across all ocean industries

Table 5.8 presents the feedback and decision regarding megatrend 4. Participants reached consensus in terms of the importance thereof and confirmed that a paradigm shift was required to improve productivity to world standards if South Africa wanted to promote resilient ocean economies. Despite the probability of occurrence Likert scale score of 3, the participants cited that labour productivity was key. Knowledge had been made widely-available through the internet, so a competitive advantage could now only be achieved through enhanced productivity. Increased productivity was the opposite objective of organised labour, which was why the probability was low and the country needed to make better use of technology, skills and knowledge available in leveraging the ocean economy. If South Africa, towards 2060, wanted to have a skilled workforce and extensive knowledge base results, new innovative ideas of improving performance and leading to increased productivity, which would contribute to a resilient ocean economy were needed.

Table 5.8: Evaluating megatrend 4 and implications for South Africa's ocean economy towards 2060

Megatrend 4: Resilient ocean economies with increased knowledge and labour productivity across all ocean industries				
Megatrend 4	Collective Likert score (importance of the megatrend)	4.0	Collective Likert score (probability of occurrence)	3.0
Decision on Megatrend 4	Keep the formulation (Average score 9 /10 =90%) * Towards 2060, South Africa would have an increasingly knowledge-intensive sector, characterised by an increased level of specialisation and labour productivity that promoted a resilient ocean economy.			

Source: Researcher's own construction.

The feedback and decision on megatrend 4 as highlighted in Table 5.8 emphasised the importance of upskilling employees within the ocean economy to remain on par with the world standards in competing in the global ocean economy space. In analysing the supporting statement that considered the South African regulatory (taking into consideration current policies and legislation) environment stimulating such a trend, five out of the ten participants selected the positive (YES) citing that, current regulations and policies had seen some strides but this needed to be re-investigated as there were insufficient South African seaman employed on vessels and there were no aggressive policies on growing the country's ships registry. The second support statement considered key ocean economy industries or activities in South Africa such as fishing, tourism and transportation and how they would promote employment creation, increase education, training and skills development for the future and increase knowledge on all ocean industries. Of the ten participants, nine selected a positive (YES) response and cited that there were diversified opportunities within the ocean economy that were key to development, however, correct strategies just needed to be in place. Participants further cited that there was an opportunity for growth in this industry if the country could leverage opportunities presented by the fishing, tourism and transportation sectors and increase productivity across all industries.

The third support statement considered how South Africa, through increased knowledge, would reduce environmental challenges that had major implications for global biodiversity, infrastructure, human health and wellbeing as well as the productivity of ocean industries. Of the ten participants, none selected a positive (YES) response and emphasised that awareness and education were needed as it was believed that when people were well-informed, their behaviour changed. Participants also cited that going into the future, increased knowledge would lead to new discoveries in managing the environmental dynamics. The fourth and last support statement considered a technological perspective, as robots and artificial intelligence took on more jobs within the ocean economy, costs should decrease, and more people would be able to afford better products and services. Of the ten participants, five selected a positive (YES) response and emphasised that this was a bitter-sweet statement, technological advancement was necessary, but where would people find other opportunities within the ocean economy to explore other than employment. Participants also highlighted that 4IR would call for more high-level skills and could create new employment opportunities and research and knowledge creation areas.

5.4.4.5 Megatrend 5: Antifragile global trade that empowers local communities, youth and women

Table 5.9 presents the feedback and decision regarding megatrend 5. Participants reached consensus in terms of the importance thereof and confirmed that policies which tapped into creating an enabling environment for the youth and women needed to be monitored as communities were still not fully included in the ocean economy. Despite the probability of occurrence Likert scale score of 3, the participants cited the trend could be realised or achieved through intentional targets, for example, learnerships/internships, which drove local community participation. This would further be possible if the country could speed up the process of inclusion of these groups in the planning, designing and implementation of an ocean's economy. As things stood, South Africa was moving slowly in advancing this transformative move. If South Africa, towards 2060 wanted to have an inclusive ocean economy, empowered youth and women could contribute significantly to the South African economy. Legislation and incentives might be needing to be introduced to encourage this more, especially through the private sector and the multinational partnerships that the country had.

Table 5.9: Evaluating megatrend 5 and implications for South Africa's ocean economy towards 2060

Megatrend 5: Antifragile global trade that empowers local communities, youth and women				
Megatrend 5	Collective Likert score (importance of the megatrend)	5.0	Collective Likert score (probability of occurrence)	3.0
Decision on Megatrend 5	Keep the formulation (Average score 9 /10 =90%) * Towards 2060, South Africa would have antifragile global trade characterised by an increased level of involvement of local communities, youth and women in the design and implementation of a sustainable ocean economy.			

Source: Researcher's own construction

The feedback and decision on megatrend 5 as highlighted in Table 5.9 emphasised the importance of involving and empowering local communities, youth and women in the ocean economy. Participants highlighted that the South African ocean economy was still characterised by marginalisation of some groups. Transformation of the industry was important for an inclusive ocean economic growth. In analysing the supporting statement that considered the South African regulatory (taking into consideration current policies and legislation) environment stimulating such a trend, seven out of the ten participants selected the positive (YES) citing that regulations and policies were there, but South Africa could stimulate such involvement by implementing and monitoring the policies and regulations in place. The opening up of Africa market through African Continental Free Trade Area (AfCFT) was also crucial for enhancing current trade relations with EU and China as well as creating more opportunities for previously marginalised groups. The second support statement considered accelerated scientific and technological breakthroughs and improved human conditions for the youth and woman in South Africa and how this would promote empowered local economies in ocean economy sectors. Of the ten participants, eight selected a positive (YES) response and cited that there were diversified opportunities within the ocean economy that were key to development, correct strategies just needed to be in place. Participants further cited that youth and women formed part of the majority population. Therefore, having them in their numbers participating in the mainstream economy could improve the local economy.

The third support statement considered how reduction in the dropout rate in the education system from the youth, and concerted efforts on capacity building for women would empower local communities and assist with a bigger skills pool for promoting antifragile global trade and ocean industries. Of the ten participants, none selected a positive (YES) response and emphasised that causal factors for dropouts needed to be addressed. For example, the youth needed to be incentivised to complete school (bursary programmes) and the government Youth Employment Scheme programme, to champion careers in the ocean's economy, needed to be expanded and adapted. Participants also cited that going into the future, the investigation on the reasons for dropouts was key to addressing the issue and promoting skilled youth to fulfil the country's economic development goals and the world at large.

The fourth and last support statement considered how South Africa would have sufficient investment to promote adequately skilled women and youth that would be competent in championing global trade and promoting sustainable ocean economies. Of the ten participants, eight selected a positive (YES) response and emphasised that sustainability in all ocean economy sectors would positively impact on the investments, and the latter promoting women and youth development. The country, however, needed to address the issues that spoke to regulatory framework for investments, provide infrastructure ahead of demand, ensure infrastructure maintenance, provide an inclusive platform for creating opportunities, reduce corruption and crime, reduce the cost of doing business and provide an uninterrupted electricity supply. Participants also highlighted that through promoting and creating awareness about the oceans and the opportunities that it provided, women and youth would take advantage of this and select skills that were relevant to the ocean's economy.

5.4.4.6 Megatrend 6: Economic impact of disease events (COVID-19)

Table 5.10 presents the feedback and decisions regarding megatrend 6. Participants reached consensus in terms of the importance thereof and confirmed the current pandemic had, hopefully, taught the country's leaders a lot towards preparing South Africa for future similar events. If South Africa, towards 2060, wanted to continue promoting economic growth and sustainable development, lessons learned from Covid-19 had to be taken into consideration when developing strategies and policies in the future. The average probability score of 3 was largely attributed to participants citing that the current track record to date in dealing with COVID-19 pandemic would impact unless major strides made through implementing lessons that were learned. The participants concluded that the country's preparedness in combating the epidemics was important for a sustainable ocean economy.

Table 5.10: Evaluating megatrend 6 and implications for South Africa's ocean economy towards 2060

Megatrend 6: Economic impact of disease events (COVID-19)				
Megatrend 6	Collective Likert score (importance of the megatrend)	4.0	Collective Likert score (probability of occurrence)	3.0
Decision on Megatrend 6	Keep the formulation (Average score 10 /10 =100%) *Towards 2060, South Africa would be better prepared in disease management and prevention which would assist in reducing the impact epidemics had on people's health and livelihoods far beyond the direct effects of the outbreak in the sectors of the countries where the disease occurred, thus, reducing the economic and social impact of disease events for the ocean economy, which was a global industry.			

Source: Researcher's own construction.

The feedback and decision on megatrend 6 as highlighted in Table 5.10 emphasised the importance of proactiveness, learning from historical incidents and other countries as well as implementing corrective measures in advance for dealing with the health of the population and economic growth. In analysing the supporting statement that considered South African's regulatory (taking into consideration current policies and legislation) environment stimulating such a trend, eight out of the ten participants selected the positive (YES) citing that, COVID-19 regulatory framework should be used as a springboard to fight the future epidemics. The South African government needed to re-evaluate and apply lessons learned in a more efficient and effective manner in terms of updating their policies and implementing the legislations in place. The second support statement considered increasing migration patterns and highly-dense urban areas in South Africa and how these patterns would make it difficult for the country to reduce the threat of new and re-emerging diseases and immune microorganisms in ocean-related industries. Of the ten participants, eight selected a positive (YES) response and emphasised that diseases spread more easily in densely populated areas as evidenced by COVID-19. The spatial patterns in South African township environments and the availability of portable or clean water specifically were a cause for concern.

The third support statement considered advances in artificial intelligence, robotics and other technologies that would fundamentally change employment in some ocean economy sectors and create new opportunities to safely and efficiently explore, alternative work situations or solutions for the future by stimulating such a trend. Of the ten participants, eight selected a positive (YES) response and emphasised that Covid-19 was an excellent example that had shown that there were alternatives ways of doing work outside the work environment. Participants further cited that artificial intelligence, robotics and other technologies could assist to minimise the risks of infections, which might be useful to substitute human power in the event there were shortage of such owing to the pandemic. The fourth support statement considered increased investment in ocean economy industries and how they would lead to effective solutions, better connectivity for all stakeholders and prompt communication on disease events (for example, rollout of the vaccine to most of the population). Of the ten participants, seven selected a positive (YES) response and emphasised that this supporting statement would lead to improvements but might not initially achieve the desired effect unless discipline and accountability by all parties were implemented. Participants also cited that improved investment and increased collaboration of all ocean economy stakeholders would ensure that the mobilisation of resources was effectively done.

The fifth and last support statement for megatrend 5 considered the changing nature of work in South Africa and an increased remote world of work, which reduced carbon emission from travelling and positively impacting the ocean environment. Of the ten participants, nine selected a positive (YES) response and emphasised that this supporting statement would only impact significantly if all forms of travel affecting the environment were addressed to ensure less carbon emissions and Greenhouse gases. Participants further cited that working from home had provided a new way of working and less cars on the road, but the heavy polluters, namely, trucks were still on the road, who were also a major contributor to CO_2 emissions and this might deter the country from positively impacting the ocean environment as the fewer carbon emissions that were produced, the better for the ocean to absorb it while also releasing more oxygen.

In summarising the section on the proposed megatrends, all participants indicated positively on the decision to keep all six megatrends and considering the importance collective Likert scoring for all six megatrends, they rated them between 4 and 5, implying that they were all important and significant for South Africa's ocean economy. The insights provided suggested that it was imperative to analyse the identified global megatrends trends so that South Africa could gain a strong foothold in the ocean economy through education, skills development and job creation. Participants further cited that significant changes were taking place in the global space such as aquaculture, cabotage, block chain, digitisation, scientific research, oil and gas, maritime education, rationalisation were all important aspects to be delved into as scenarios were developed and planned for the future of South Africa's ocean economy towards 2060.

5.5 KEY ENABLERS OR DRIVER(S) THAT WOULD SHAPE THE FUTURE OF SOUTH AFRICA'S OCEAN ECONOMY TOWARDS 2060

This section analyses the key enablers or drivers that shape the future of the ocean economy as contained in Part 3 of the real-time Delphi study. The researcher identified seven enablers and Table 5.11 provides insight as to how the participants ranked the importance of the enabler or driver in shaping the future of the ocean economy and provided additional comments in the chosen scale.

Table 5.11: Evaluating key enablers or drivers and their importance in shaping the future South Africa's ocean economy

Key enabler or driver	Collective Likert score and Additional comments	
1. Social drivers associated with employment creation would ensure alternative employment, innovative energy sources and promote responsible and sustainable use of ocean resources.	Collective Likert score (the importance of this enabler or driver in shaping the future of the ocean economy)	4.5
	Additional comments: Participants highlighted that maritime transport was catalytic in growing the global economy and played an essential part in the mobility of both trade and people, which could facilitate a number of employment creation opportunities. With over 80% of world trade carried by ships there were vast numbers of passengers and seafarers involved. The social welfare of seafarers for instance was vital, otherwise both trade and transport could not function adequately. Participants concluded that activities within the oceans, be it economic and/or social, played a vital role in job creation whether in the upstream or downstream ocean economy sectors.	
2. Technological drivers (for example, new workflows, automated vessels and new logistical processes) would be successfully utilised to drive sustainable process innovations in the ocean economy.	Collective Likert score (the importance of this enabler or driver in shaping the future of the ocean economy)	4.0
	Additional comments: Participants highlighted that South Africa, in line with global trends, had already started seeing the impact of blockchain, digitisation, rationalisation and technical anti-pollution measures(scrubbers) playing a significant role in expediting cargo processes and combating pollution in the ocean and associated industries. In terms of port efficiency, which was one of the key decisions that ship liners made when visiting ports and investment attractions, the country was making good strides towards technology aids aimed at improvement of efficiencies within South African ports and the overall logistics chain. Lastly, participants highlighted that technological drivers would improve the efficiency and effectiveness of the current ocean economy sub-industries. which would then unlock new and previously unthought of opportunities.	
3. Economic drivers associated with increased investment, partnerships/privatisation and innovative funding solutions, for example, crowdfunding, would drive	Collective Likert score (the importance of this enabler or driver in shaping the future of the ocean economy)	4.0
	Additional comments: Participants highlighted that South African State-Owned Enterprises (SOEs) who were at the forefront of investment and operation in the ocean economy development, were faced with the challenge of funding projects, an opportunity for driving these projects was exploring private and public partnerships. Ocean's economy development activities were capital intensive, therefore, partnerships with people who had resources could help to drive the development of the sector. It	

Key enabler or driver	Collective Likert score and Additional comments	
advanced ocean economies in the African continent and globally.	was difficult to get work done independently in the sector as it required significant capital to start the business. Lastly, participants highlighted that partnerships in investments in terms of infrastructure and superstructure would contribute to improved efficiencies and positioning of the African continent's ports in the global maritime space.	
4. Environmental drivers associated with climate change and how countries respond to challenges posed by ocean acidification, would change the way natural resources and energy from the ocean were produced and used, and the way land and resources were managed as well.	Collective Likert score (the importance of this enabler or driver in shaping the future of the ocean economy)	5.0
	Additional comments: Participants highlighted that academic research and climate change responses would increasingly be required by the industry and related fields of study to become more highly specialised. Participants also highlighted that for the ocean economy, like all the other industries, its success and sustainability relied more on research and development as well as innovation to harness environmental challenges like pollution and new technological changes as well as developing strategies that would respond to such global changes.	
5. Political drivers associated with credible leaders and government structures would promote sustainable ocean economies based on decisions that benefitted the country and not individuals.	Collective Likert score (the importance of this enabler or driver in shaping the future of the ocean economy)	4.0
	Additional comments: Participants highlighted that a stable political state was important to drive investment promotions. South Africa needed a stable political state that was free of corruption. Participants further highlighted that ethical leaders attracted investors and gave political stability which, in turn, attracted investment and increased trade, which would grow the ocean economy sectors.	
6. Legal drivers associated with sustainable ocean economy decision-making processes that were transparent, participative, and	Collective Likert score (the importance of this enabler or driver in shaping the future of the ocean economy)	4.0
	Additional comments: Participants highlighted that South Africa, in line with global trends, needed to strictly comply and implement MARPOL, IMO and United Nations regulations and standards to improve the business environment and grow the ocean economy. Participants further highlighted that legally	

Key enabler or driver	**Collective Likert score and Additional comments**	
accountable at all times and under legal and societal scrutiny.	sound policies, which did not discriminate were a good foundation that could enhance the growth and development of the ocean economy. Furthermore, the development process of such policies should be transparent and participatory to ensure that all those who would be affected by them participated and expressed their voices.	
7. Ethical drivers associated with ensuring that adequately-skilled and competent people were allowed to champion all the key ocean economy sectors to promote a sustainable ocean economy that ensured the protection, preservation and conservation of the ocean space so as to protect endangered ecosystems and species.	Collective Likert score (the importance of this enabler or driver in shaping the future of the ocean economy)	4.0
	<u>Additional comments:</u> Participants highlighted that all parties connected to the maritime industry needed to be consulted and spatial planning implemented to cater for all interested parties involved in ocean matters. Participants also cited that all those who were tasked with responsibilities to manage and deal with the ocean's economy, should be competent and ethical for the investors to have confidence before investing their resources. Lastly, participants cited that this was a base requirement across all sectors of the economy and was not unique to the ocean economy if the country was to shape a sustainable future for the country and future generations.	

Source: Researcher's own construction.

5.6 WILD CARDS THAT HAVE DISRUPTED AND CHANGED THE OCEAN ECONOMY

This section analyses the identified wild cards as they applied to key ocean economy sectors/industries, namely, marine transport and manufacturing, offshore oil and gas exploration, fisheries and aquaculture, small harbours, coastal and marine tourism and marine protection services and ocean governance. Wild cards refer to low probability shock events that have very high impacts, thereby altering the "fundamentals and creating new trajectories which can then create a new basis for additional challenges and opportunities that most stakeholders may not have previously considered or prepared for" (Saritas & Smith, 2011:295). The researcher identified eight wild cards and Table 5.12 provides insight as to how the participants ranked the importance of the wild cards in shaping the future of the ocean economy and provided additional comments on the chosen scale.

Table 5.12: Evaluating wild cards and their importance in shaping the future South Africa's ocean economy

<table>
<tr><th>Wild card</th><th colspan="2">Collective Likert score and Additional comments</th></tr>
<tr><td rowspan="2">1. Higher pollution possible through oil spills and waste from ships and other land-based sources (for example, sewage, litter from rivers flowing into the sea).</td><td>Collective Likert score (the importance of the wild card in disrupting and changing the future of the ocean economy)</td><td>4.0</td></tr>
<tr><td colspan="2">Additional comments: Participants highlighted that proper studies were important before carving out an activity at sea or on land. Feasibility studies, pilot studies, risk assessment should not be taken for granted. Oil spills in South Africa (such as the Algoa Bay region) were mostly attributed to lack of risk assessment being conducted for bunkering operations, which had seen oil spills in the area in the 2019/2020-year period. Pollution had a detrimental impact for the environment in terms of survival of the fish, plant species and other living organisms, which were vital in South Africa's ocean. The vessels contaminated by the invasive alien species also had a high probability of carrying these and contaminating other areas. Pollution, whether it was plastic from shore, oil spills, invasive species or waste from ships and noise from drilling operations or vessels could negatively impact and change the ocean environment if not properly managed.</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td rowspan="2">2. Widening gap between rich and poor would make ocean economy industries and sectors exclusive leading to potential clashes between various economic classes, big industries and small-scale industries.</td><td>Collective Likert score (the importance of the wild card in disrupting and changing the future of the ocean economy)</td><td>4.0</td></tr>
<tr><td colspan="2">Additional comments: Participants highlighted that owing to a lack of resources, capital and know how, there was a very strong chance that the poor would be more marginalised than ever before if not included in the mix. In terms of the quadruple helix for the maritime industry, it was important that the poorer communities be consulted and incorporated in an endeavor to address this great divide. Participants also cited the barriers to entry in many ocean economy industries, particularly, starting a business within the ocean economy required significant finance, the gap between the rich and poor could be widened if there were no concerted efforts to help the previously disadvantage or the poor to actively participate in the space through funding and incentives from government and private companies.</td></tr>
<tr><td colspan="3"></td></tr>
</table>

Wild card	Collective Likert score and Additional comments	
3. Disruptive technologies (for example, artificial intelligence, big data, blockchain) would drive academic programmes, research and business innovation cycles within the ocean economy.	Collective Likert score (the importance of the wild card in disrupting and changing the future of the ocean economy)	4.0
	Additional comments: Participants highlighted that with the ever-changing cargo patterns and markets the shipping industry needed to be sustainable and these disruptive technologies were essential to achieving this objective. The context of the shipping industry was continuously changing, and technological innovation was key to sustainability in the ensuing years. Participants also cited that there would be disruptions and changes, and that there would definitely be further disruptions brought about by robotics, blockchain and big data that essentially needed to be factored in advance when considering the future of the ocean economy.	
4. High resolution ocean floor mapping would promote an overall understanding and real-time monitoring of environmental changes owing to excessive exploitation, climate change and pollution within the ocean environment.	Collective Likert score (the importance of the wild card in disrupting and changing the future of the ocean economy)	5.0
	Additional comments: Participants highlighted that this wild card would be a game changer and would make ocean exploration as attractive as space exploration in many parts of South Africa and globally. Participants further cited that in changing the future, it would be essential to ensure that informed and coordinated decisions were mapped out on how to ensure the sustainability of marine resources. A maritime spatial plan should include multiple users of the ocean including energy, industry, government, conservation and recreation to achieve desired objectives.	
5. Smart shipping and ports, smart fish extraction and processing facilities would reduce the employment opportunities identified within the ocean economy.	Collective Likert score (the importance of the wild card in disrupting and changing the future of the ocean economy)	4.0
	Additional comments: Participants highlighted that assistive technologies for navigation and data sharing were developments that were all part of smart shipping. This made the shipping industry more competitive, safer and more sustainable. As a country, South Africa was compelled to embrace these developments to keep up with the rest of the maritime industry. It was true that this would reduce the crew on ships and landside staff complements, so, the labour force rather needed to be up-skilled in these areas. There would, however, be opportunities for research, innovation and technology and this was an area where South Africa could contribute. Participants further cited that with automation, measures should be put in place to ensure that alternative ways of creating jobs, within the same ocean industry	

Wild card	Collective Likert score and Additional comments	
	sector that were being disrupted and changed by technological innovations, were made available.	
6. Traceability of fish stocks and fish products would combat illegal, unreported and unregulated (IUU) activities and reduce crime, which would lead to improved governance required to preserve and rebuild fish stocks.	Collective Likert score (the importance of the wild card in disrupting and changing the future of the ocean economy)	4.0
	Additional comments: Participants highlighted that the globalisation of the fish industry meant that this product could travel great distances to the ultimate consumer. The quality and safety of the product should not be compromised in any way. Participants also cited that there was often illegal fishing in a country's territorial waters with little or no monitoring at all by South African coastal patrols). Appropriate legislation and controls for producers, processors and retailers needed to be implemented. In addition to this, it would be necessary to have regular naval patrols policing territorial waters to eliminate disruptions associated with fish stocks and fish products.	
7 (a). Ethical wild cards linked to increased corruption and maladministration would create instability and dysfunctional ocean economies.	Collective Likert score (the importance of the wild card in disrupting and changing the future of the ocean economy)	5.0
	Additional comments: Participants highlighted that people with questionable characters and criminal activities in the ocean space were a threat to the development and growth of any economic sector. Investors would not be motivated to invest their resources to where they were not sure about the returns. Therefore, unethical and maladministration would have a negative impact on the growth and development of ocean economy.	
7 (b) Ethical wild cards linked to terrorism (such as, piracy) would create instability and dysfunctional ocean economies.	Collective Likert score (the importance of the wild card in disrupting and changing the future of the ocean economy)	4.0
	Additional comments: Participants highlighted that piracy remained a constant threat as evidenced with Somali pirates and could easily extend to South African territories, so measures should be put in place to guard against this and protect vessels entering South African waters. Lastly, participants cited that with the current economic state in South Africa and the rising unemployment figures, piracy might be a threat, but this would decrease over time as technology advances reduced the opportunities for such illegal acts and increased accountability placed on government and citizens collectively.	

Source: Researcher's own construction.

Table 5.12 shows that of the seven wild cards identified (with the exception of number seven having two sub-areas), five were ranked 4/5 and two were ranked 5/5 signifying the importance of wild cards in shaping the future of the ocean economy. Comments shared by the participants mainly included coordinating maritime activities and promoting transparent and ethical processes for all key sectors to ensure that the wild cards identified did not negatively change or alter the ocean economy. Participants also identified that what was key for promoting future developments was ensuring that informed and coordinated decisions were mapped out on how to ensure the sustainability of all marine resources.

In summarising the real-time Delphi, it was important to note that this approach was used in the research to confirm the proposed six megatrends, to gain insight on the key enablers and the identified wild cards as well as to build on the scenario planning aspect of the study, which is explored in Chapter 6 for South Africa's ocean economy towards 2060. A total of 103 questions formed part of the real-time Delphi process, and in promoting the sequential mixed method research approach, 64 worded statements or closed questions and 39 open-ended questions on ocean economy development were tested on a purposively sampled population. This was done to significantly contribute to the overall development of a quantitative and qualitative view of South Africa's ocean economy and develop scenarios inclusive of all six sectors towards 2060.

5.7 USING REAL-TIME DELPHI RESULTS AS A BASIS FOR DEVELOPING SCENARIOS

The real-time Delphi technique is a structured communication technique that allows for interactive forecasting based on feedback from a panel of experts (Gordon, 2009). The technique obtains continuous feedback from experts, where anonymous feedback is constantly provided on the experts' forecasts as well as the reason why such answers are provided. The experts are encouraged to revise their answers considering the feedback and thereby driving a structured group forecast rather than an individual observation, which can often be skewed (Gordon, 1994). Strengths of the technique include the speed at which feedback is obtained, flexibility, and a centralised database of questions and answers, while the general weakness observed is the failure to attract participants back for re-estimation of answers (Gordon, 2009). The real-time Delphi confirmed the megatrends, which were the paradigm shifts happening at the intersection of cultural, social, economic, political, technological, regulatory and market forces with South Africa's ocean economy (The Economist, 2015). Using the real-time Delphi and the semi-structured interviews also promoted triangulation in the study. The idea of triangulation was discussed by Guba and Lincoln (1994) as a form of trustworthiness for qualitative research studies. While it was accepted as a means of showing rigour in the research approach, triangulation is also recognised more recently as needing further consideration as it is built upon a general concept that the data will overlap and show the same findings, which was the case with the megatrends tested in both data collection methods. The identified megatrend and drivers are summarised in the Table 5.13 and form the basis for the proposed four scenarios for South Africa's ocean economy towards 2060.

Table 5.13: Megatrends and key ocean economies affected and teal-time Delphi results

Megatrend 1: Meeting future energy demands through sustainable ocean industries **Key ocean economy sector(s) affected: All**	
Main Driver (s) - Linked to environmental scanning process	**Formulation on megatrend and decision based on real-time Delphi results**
Social drivers associated with population growth trends, employment creation needed as well as the environmental driver that speaks to climate change and ensuring that alternative energy initiatives did not deplete natural resources or harm the environment. Economic drivers associated with increased investments for alternative energy sources, climate change mitigation research/strategies and innovative, yet affordable energy initiatives in South Africa remained key.	*Towards 2060, South Africa would be able to meet growing energy demands safely and efficiently through sustainable mechanical and thermal ocean energy industries. ***Keep the formulation = Yes***
Megatrend 2: Smart population driving ocean economy development and improved social standards **Key ocean economy sector(s) affected: All**	
Social drivers associated with migration patterns towards coastal cities, promoting education and training and skills development for the future. Technological drivers (increasing reliance on digital and autonomous systems). Economic drivers (investments and employment creation).	*Towards 2060, South Africa would have a smart population driving ocean economy development and improved social standards. ***Keep the formulation = Yes***

Megatrend 1: Meeting future energy demands through sustainable ocean industries **Key ocean economy sector(s) affected: All**	
Political and legal drivers associated with governments adopting friendlier policies that assist with technological catch-up and the absorption of knowledge.	
Megatrend 3: Food security and improved standards of living through technological breakthroughs **Key ocean economy sector(s) affected: FA, MT, MPSOG, SHD and CMT**	
Social drivers (high rate of urbanisation or increased population trends would lead to increase economic activity and consumption levels on ocean resources, employment creation, education and training and skills development for the future). Economic drivers (investment in aquaculture, food security, processing and employment creation). Environmental drivers (ocean environment was facing unprecedented change as a result of direct human activity and climate change),	*Towards 2060, Technological breakthroughs in South Africa would promote food security, sustainable extraction and consumption levels on ocean resources and improved standards of living. ***Keep the formulation = Yes***
Megatrend 4: Resilient ocean economies with increased knowledge and labour productivity across all ocean industries **Key ocean economy sector(s) affected: All**	
Technological drivers (Increasing reliance on satellites and data sharing, advances in autonomy and other technologies were expected to fundamentally change employment in some marine sectors, and create new opportunities to safely and efficiently explore, monitor and work at sea). Ethical drivers (ensuring a sustainable ocean economy entailed protection, preservation and conservation of the ocean space so as to protect endangered ecosystems and species; and so, it was critically important to ensure that adequately skilled and competent people were allowed to champion all the key priority sectors).	*Towards 2060, South Africa would have an increasingly knowledge-intensive sector, characterised by an increased level of specialisation and labour productivity that promoted a resilient ocean economy ***Keep the formulation = Yes***
Megatrend 5: Antifragile global trade that empowers local communities, youth and women **Key ocean economy sector(s) affected: All**	
Social drivers (promoting education and training and skills development for the future for all). Economic drivers (promoting and incentivising investments as well as long-term	*Towards 2060, South Africa would have antifragile global trade characterised by an increased level of involvement of local communities, youth and women in the

Megatrend 1: Meeting future energy demands through sustainable ocean industries **Key ocean economy sector(s) affected: All**	
employment opportunities that empowered local communities, youth and women). Political drivers (governments must adopt friendlier policies that assist with technological catch-up and the absorption of knowledge for all and accelerate the implementation of preferential policies).	design and implementation of a sustainable ocean economy. ***Keep the formulation = Yes***
Megatrend 6: Economic impact of disease events (COVID-19) **Key ocean economy sector(s) affected: All**	
Economic drivers associated with investments and establishment of industries which, in return, affected the state and capacity of countries to provide for themselves during the time of emergencies. Technological drivers associated with big data analytics, digitalisation and more advanced communications would lead to better connectivity and prompt communication on disease events and solutions.	*Towards 2060, South Africa would be better prepared in disease management and prevention, which would assist in reducing the impact epidemics had on people's health and livelihoods, thus, reducing the economic and social impact of disease events for the ocean economy, which was a global industry. ***Keep the formulation = Yes***

*Key sectors were abbreviated as follows, if the megatrend did not apply to all. Marine Transport = MT, Offshore Oil and Gas Exploration = OOGE, Fisheries and Aquaculture = FA, Marine Protection Services and Ocean Governance = MPSOG, Small Harbours Development = SHD and Coastal and Marine Tourism = CMT.

Source: Researcher's own construct.

As shown in Table 5.13, the real-time Delphi methodology provided an attractive way of developing a scenario matrix that took into consideration expert opinions on effective policies, future trends and decisions (Gordon, 2009) as well as key enablers and wild cards for South Africa's ocean economy towards 2060. The two most important megatrends that would shape the future included sustainable energy provision and food security: Energy demands remained key as South Africa needed to meet the current and future energy demands of the country in terms of electricity /power and water provision. As highlighted in Chapter 3, food security remained key as many people in developing countries, as fish and other seafood caught by small-scale fishers were particularly important for their health (FAO, 2016).

5.8 SUMMARY

The chapter presented key elements of the real-time Delphi method, which were employed to check the future importance and probability of occurrences of the identified trends in Chapter 4 and drivers in the ocean economy. The real-time Delphi method allowed the researcher to explore questions about the future of South Africa's ocean economy, effective policies and decision-making as well key drivers for the sector to a sample of key experts and industry practitioners in the ocean economy space. A detailed description of the real-time Delphi method, as well as the suitability of the method for an ocean economy future study was also presented. The chapter also provided the final outcome of the real-time Delphi study, as well as the megatrends and driving forces and a futures triangle used in the construction of scenarios for South Africa's ocean economy towards 2060.

CHAPTER SIX

PROPOSED SCENARIOS FOR SOUTH AFRICA'S OCEAN ECONOMY TOWARDS 2060

6.1 INTRODUCTION

Chapter 5 presented the outcome of a real-time Delphi survey, which addressed megatrends and drivers considered important and most likely to influence the future of South Africa's ocean economy. This chapter outlines the scenario process and proposes possible scenarios for South Africa towards 2060. The scenarios were based on the results of a comprehensive environmental scan (see Chapters 3 and 4) and the outcome of the real-time Delphi survey (see Chapter 5). It addresses those changed areas, which are considered most likely to shape the future of South Africa's ocean economy towards 2060. The first part of the chapter presents the key definitions regarding scenarios and scenario planning, as well as their purpose and value in development planning. In addition, scenario planning is also described and proposed as a tool to create alternative futures for South Africa's ocean economy towards 2060. The second part of the chapter presents a detailed description of the scenario development process, as well as four proposed scenarios that might guide the future for South Africa's ocean economy towards 2060.

6.2 SCENARIOS AND DEVELOPMENT PLANNING

From a developmental perspective, the key purpose of scenarios is to highlight the central elements of a possible future, and to draw attention to the key factors that would drive future developments (Kreibich et al, 2011). Department of Environmental Affairs (2013) and states that scenarios are sets of narratives about the future and have been employed by decision makers in the business community and elsewhere for several decades as an alternative to predictions, forecasts, and other single-future planning processes. Bizikova et al, (2014) also highlight the suitability of scenario development in adaptation planning, which is evident in the World Bank study of Economics of Adaptation to Climate Change (EACC). As a result, scenarios can be used to identify possible weak signals or disruptive events, which can then be incorporated into long-range planning for development.

The need for a forward-looking approach in promoting a sustainable ocean economy and development in general, is emphasised by Swanson, Bizikova, Thrift and Roy (2014), O'Neill, et al (2014) and the United Nations Development Programme (2013), which highlight the need for a multigenerational perspective to development. Swanson et al (2014:4) emphasise that sustainable-development strategies require a long timeframe to implement the concepts of "intergenerational equity", which is one of the fundamental underlying principles of sustainable development. In addition, the key drivers of change in the ocean economy, such as climate change, population growth and technological innovations, are also long-term in nature (Msangi & Rosegrant, 2011; Swanson et al, 2014). This inevitably requires next-generation development frameworks to fully understand the potential future impact thereof.

In the study, a distinction was made between three different roles of scenarios. This gives an indication of their usefulness in dealing with complex issues, such as the ocean economy and includes:

- Identification of future socio-economic challenges,
- Identification of socio-economic changes important for dealing with climate change impacts and a sustainable ocean economy for South Africa towards 2060 (which could be any other long-term socio-economic and environmental impact),
- Identification of innovations key for growing the ocean economy and addressing socio-economic challenges and options linked to growing a sustainable ocean economy.

The usefulness of scenarios in development planning is also highlighted by Swanson et al (2014) who illustrates their ability to stimulate engagement in the process of change. In this regard, Swanson et al (2014) highlights scenario planning as a well-suited method to harmonise diverse socio-economic and environmental goals. For Swanson et al (2014), the benefits of scenarios for decision-makers are:

- Linking contradictory information,
- Understanding of the dynamics of change,
- Providing clues to the timing of key moments of change,

- Identifying a fuller range of opportunities and threats,
- Providing transparency of decision-making,
- Ensuring a thorough assessment of the risks,
- Providing a sound basis for continuous monitoring of the environment,
- Creating strategies that exhibit a greater degree of resilience and flexibility.

6.3 SCENARIO DEVELOPMENT AND TYPE OF SCENARIOS

Scenarios, as a prime technique of future studies, have long been used by government planners, corporate managers and military analysts as powerful tools to aid in decision making in the face of uncertainty (Mietzner & Reger, 2005; Glenn, 2009). A scenario approach involves developing future environment situations and describing the path from any given present situation to these future situations (Ratcliffe, 2000). In this study, a scenario development process was used to aid decision making in the face of uncertainty and develop future environment situations that would be key for a sustainable ocean economy for South Africa towards 2060. The various types of scenarios are explained in this section and the scenario approach that was followed in this research.

6.3.1 Types of scenarios

The scenario approach starts from the explicit assumption that the future is fundamentally unpredictable. Therefore, unlike traditional forecasting or market research, based on extrapolating current trends, scenarios present alternative images and memories of the future (Ingvar, 1985). There are several scenario typologies available, such as those proposed by Ducot and Lubben (1980), Duncan and Wack (1994), Godet and Roubelat (1996), Postma et al. (1995), and Heugens and Van Oosterhout (2001) which were highlighted in the OECD (2006) Think Scenario Rethink Education book (OECD, 2006). Each of these identifies fundamental distinctions between scenario types, but as the typologies reflect the state of play at the time, they become outdated as the field evolves. Another problem is that typologies often fail to capture the full range of contemporary scenario development (OECD, 2006). Heugens and Van Oosterhout's (2001) typology is more recent than Ducot and Lubben's (1980) but less detailed. As cited in the OECD (2006), business-oriented classifications such as Duncan and Wack's (1994) do not take account of differences between macroeconomic and environmental scenarios. Therefore, the existing classifications are found to be a source of inspiration but not detailed enough for an in-depth analysis, nor broad enough to do justice to the variety of today's scenario development approaches (OECD, 2006).

6.3.1.1 Process-oriented scenario development

Process-oriented scenario development functions to promote learning, communication and improving observational skills. The learning/educative function is about informing people (Van der Heijden et al, 2002) by deciphering the often-confusing overload of information (Duncan & Wack,1994 cited in OECD, 2006), and integrating possible future events and developments into consistent pictures of the future. Making sense of the future, in this way, can challenge mental models and prevailing mind-sets (Wack, 1985; Schoemaker, 1995 in Racliffe, 2000), and can involve learning from the past and investigating fundamental uncertainties about the future. The educational aspect of scenario development may well serve to improve participants' intellectual and creative skills (Ratcliffe, 2000). Ultimately, scenarios might serve as a vehicle to instil a consciousness of the future in society (Van Steenbergen and Shah, 2003). Scenarios may also have a communicative function (Van der Heijden et al, 2002; Masini & Vasquez, 2000). The process of scenario development provides a language to cross disciplinary boundaries. In organisations, it may provide a basis for "strategic conversations", to discuss perceptions on strategy, opportunities, and threats. Social interaction in a scenario process arguably helps an organisation to improve its perceptive ability to anticipate both difficult times and upcoming opportunities (Schwartz, 1991).

6.3.1.2 Product-oriented scenario

Product-oriented scenario studies are more concerned with the nature and quality of the output rather than with how it was arrived at. Their functions include the identification of driving forces and signs of emerging trends, policy development, and to test policy. Scenarios can be used to identify and prioritise the dangers and opportunities in emerging events and processes (Masini & Vasquez, 2000), signs of which are sometimes referred to as "weak signals", "early warnings", "seeds" or "traces". Scenarios may also be a tool for evaluating decisions and testing policy options by doing "practice runs" of possible future situations, which indicate the possible effects of decisions (Van der Heijden et al, 2002; Wilson, 2000).

The process-oriented scenario development approach was followed in this study as the researcher aimed to promote learning, communication and discuss perceptions on strategies aimed at growing and promoting a sustainable ocean economy for South Africa towards 2060.

6.3.2 Role of values in the scenario process

Some might say that all scenarios are normative in that they reflect interpretations, values and the interests of those involved in the scenario exercise (Van der Heijden et al, 2002). It is nevertheless useful to distinguish between *descriptive* scenarios and those which are explicitly *normative.* Royal Dutch Shell's 2001 global scenarios entitled Business Class and Prism, for example, outline two possible futures without indications of desirability (Shell International, 2002). In contrast, the "Balanced Growth" scenario can be referred to in The Netherlands in Triplicate study (CPB Netherlands Bureau for Economic Policy Analysis, 1992), as normative because the explicit aim is to show, given certain conditions, that economic growth can go hand-in-hand with environmental protection.

6.4 SCENARIO DEVELOPMENT USING FUTURES RESEARCH METHOD

The use of scenarios to study the future is well-known as an approach to studying situations that can lead to important changes and in which it is difficult to create explicit relationships among the events. Scenario development and planning first emerged in the 1950s through the work of Herman Kahn who, at the time, constructed scenarios in connection with military and strategic studies conducted by the US RAND Corporation (Ratcliffe, 2000; Glenn, 2009). The scenario method is a widely-used technique in futures studies. The method allows for the ability to overcome complexity, ensure focus is given to a wide range of options, empower participants, create a coherent and rational future vision and integrate diverse knowledge and create innovative views (Van Vuuren, 2002). Amer et al (2013) note that increased emphasis is being placed on the use of scenario planning in an era characterised by uncertainty, innovation and change.

As a method of studying the future, Inayatullah (2013) describes scenarios as metaphors of the possible that critique the present. Adendorff and Colliers (2015) define scenario-based planning as an enabler for decision-makers to see the future in different plausible ways and serve as a rational way of doing strategic planning based on mutual understanding between the participants. In this study, a qualitative scenario thinking approach was adopted as this would enable stakeholders to participate in agenda setting, in visioning (exploring alternative sets of futures that contained both desired and undesired events) and in policy development (to explore pathways of action towards desired future targets). As a method, scenarios, therefore, offered an internally consistent and plausible explanation and description of how events might unfold over time.

The creation of four scenarios is seen to stimulate more serious and flexible thinking about alternative possibilities for which one would have to create flexible strategies to adjust to changing futures (Glenn, 2009 cited in Koekemoer, 2019). Scenarios provide the ability for researchers to produce alternative futures based on a variety of assumptions, facts, trends and fields that require further understanding for a scenario project (Adendorff, 2013; Herbst & Mills, 2006). The goal of scenario planning is to provide several scenarios to researchers and decision-makers to allow them to better comprehend their options and possibilities (Adendorff, 2013).

6.5 CLA AND PREFERRED FUTURES FOR THE OCEAN ECONOMY

Causal layered analysis (CLA) is known as a critical futures research method, which deepens the understandings about the future changes (Inayatullah, 2004; Talebian & Talebian, 2018). According to Inayatullah (2004), CLA assumes that the way in which a problem is framed will have an impact on how a change in the issue will be pursued. As a theory, Causal Layered Analysis (CLA) seeks to integrate empiricist, interpretive, critical and action learning modes of knowing. As a method, its efficacy is not in predicting the future but in creating transformative spaces for the creation of alternative futures (Innayatullah, 2004). It is also likely to be useful in developing more effective, deeper, inclusive, longer-term policy. Causal layered analysis is concerned less with predicting a particular future and more with opening-up the present and past to create alternative futures. It focuses less on the horizontal spatiality of futures and more on the vertical dimension of futures studies, of layers of analysis. Causal layered analysis opens up space for the articulation of constitutive discourses, which can then be shaped as scenarios. In essence, CLA is a search for integration in methodology, seeking to combine differing research traditions. The pedagogical process of CLA involves moving individuals and organisations from the unexamined, taken-for-granted, single future to alternative futures and then to the preferred future. It is most commonly based on the six pillars futures conceptual framework designed to help participants, namely, (a) Map, (b) Anticipate, (c) Time, (d) Deepen, (e) Create alternatives to the futures that they envision, and (f) Transform those futures.

As highlighted by Inayatullah (2004), CLA consists of four levels, namely, the litany, social causes, discourse/worldview, and myth/metaphor. For an activity to contribute to the ocean economy of South Africa and Africa in general, it would need to include at least two of the four elements of resource efficiency, namely, reducing food loss and waste along the value chain, energy efficiency (reducing the carbon footprint), decent employment and education, research and innovative technologies (FAO, 2014; WWF, 2015a; Adendorff & Collier, 2015; Williams, 2019). The CLA approach can be used as:

- a way to understand the inner world of current and future meanings (point of view of different stakeholders),
- a stand-alone methodology to help understand and gather different perspectives on a topical issue,
- a part of a larger foresight process, especially to explore issues and scenarios.

For the purpose of this research, the CLA was used as part of a larger foresight process to explore issues around South Africa's ocean economy and a preferred future for South Africa's ocean economy towards 2060. The CLA method, which can be effectively used to unpack litanies and to uncover both simple and complex levels of causality (Inayatullah & Milojević, 2015), can ultimately assist in the reconstruction of the critical assumptions (instead of only extrapolating trends) on the way a preferred sustainable future is generated for South Africa's ocean economy. As highlighted in Chapter 1, the preferred future should be in line with the AU Agenda 2063, the 2050 Africa's Integrated Maritime (AIM) Strategy, the National Development Plan (NDP), the National Ocean Economy Strategy (also known as Operation Phakisa) and the

Dinokeng and Indlulamithi Scenarios for South Africa's economy. A causal layered analysis (CLA) also allows for a better understanding of the social and ecological implications of a possible future or scenario (Inayatullah 2004, 2008; Inayatullah & Milojević 2015). CLA assumes that the way in which one frames a problem changes the policy solution and the actors responsible for creating transformation (Inayatullah, 2004). Inayatullah (2004) further argues that futures studies should be seen as layered, as deep and shallow. Its textured richness cannot be reduced to empirical trends.

Given the complexity and the level of multi-dimensionality within ocean industries, it can be expected that changes within the ocean economy are much harder and more long-term in nature. In the process of foresight creation, it was, therefore, necessary to deepen the level of understanding regarding the future of South Africa's ocean economy. The best alternative to deepen the level of understanding within future studies was through a causal layered analysis (CLA), which was aimed at providing insights into scenarios for South Africa's ocean economy towards 2060. The CLA method, which can be effectively used to unpack litanies and to uncover both simple and complex levels of causality (Inayatullah & Milojević, 2015; Oberholster, 2017), could ultimately assist in the reconstruction of the critical assumptions (instead of only extrapolating trends) on the way the provisioning of a sustainable ocean economy is constituted. The CLA method is also supported by Burke (2015), as a mode from which a new story for South Africa's ocean economy could arise.

As a foresight methodology, CLA is also supported by Inayatullah and Milojević (2015) who argue that the method can assist in addressing and reconciling the tension between economic growth, the environment and equity, which relates to the sustainability goals and the socio-economic aspirations of people, and which may have significant implications for the future of South Africa's ocean economy. Inayatullah and Milojević (2015), Adendorff (2015) and Oberholster (2017) state that as a foresight methodology, CLA can assist in addressing and reconciling the tension between growth and equity, which relates to the socio-economic aspirations of people, which might have significant implications for the future of a sustainable ocean economy for South Africa. As the CLA method seeks to integrate the four levels of understanding (namely, litany, systemic, worldview and myth), it could also be used to inform policy- and other decision-makers of the mismatches between the layers of systemic causation and the other deeper layers, which might have significant implications for the future of a sustainable ocean economy for South Africa (Inayatullah, 2004 in Oberholster, 2017). Inayatullah (2004) and Adendorff (2015) conclude that CLA opens up space for the articulation of constitutive discourses, which could then be shaped as preferred future for South Africa's ocean economy towards 2060.

As Inayatullah (2004) explains, causal layered analysis (CLA) consists of four dimensions. The first is the litany, or the day-to-day layer, the commonly accepted headlines about the way things are or should be. Solutions to problems are, at this level, usually short-term. The second dimension is deeper, focused on the social, economic and political causes of the issue. The third dimension is the culture or worldview. This is the big picture, the paradigm that informs what is thought as real or not real, the cognitive lens used to understand and shape the world (Inayatullah, 2004, Talebian & Talebian, 2018). The fourth dimension is the myth or the metaphor, which is the deep unconscious story behind the issue. CLA seeks to integrate these four levels of understanding. Each level is true, and solutions need to be found at each level.

6.5.1 Litany level of understanding on South Africa's ocean economy towards 2060

Litany interventions lead to short-term solutions, easy to grasp and packed with data, while social and economic interventions are linked to deeper and more systemic solutions, which are usually constructed through governmental policies. Worldview change is much harder and longer-term. It requires seeking solutions from outside the framework in which the solution has been defined. And the myth solutions require the deepest interventions, as this framework requires telling a new story, rewiring the brain, and building new memories and the personal.

6.5.2 Systemic level of understanding on South Africa's ocean economy towards 2060

The level of the social cause in CLA is the systematic level in which the social causation in terms of the links between the individuals and society are analysed. According to Inayatullah (2014), the role of the state and other actors and interests is often explored at this level. As he explains, the two key questions asked at this level are, "who is responsible for this?" and "what policies and structures gave rise to this?" (Inayatullah, 2004; Talebian & Talebian, 2018). In terms of the ocean economy, as unpacked in Chapters 3, 4 and 5, multiple role-players drive and affect the sustainably of ocean industries from governments, businesses, investors, academia or researchers and communities.

6.5.3 Worldview level of understanding on South Africa's ocean economy towards 2060

To grasp the deeper layer of causes, it is important to investigate what latent worldviews provide the sociocultural constructs behind the litany layer. The language and conception play crucial roles in this stage because they do not simply reflect the world, but they constitute it, according to the post-structuralist premises of CLA. Inayatullah (2004) and Talebian & Talebian (2018) state that although CLA is primarily a post-structuralist approach, in this layer of analysis, it utilises discourse analysis as a theoretical framework as well as a methodology for social sciences and related studies in a broad sense. From the South African stakeholder view, both the government and the private business sectors need to join forces to ensure the necessary investments are obtained to ensure an adequate technological infrastructure is built to ensure participation in the global economy and in promoting a competitive ocean economy towards 2060.

6.5.4 Myth / metaphor level of understanding on South Africa's ocean economy towards 2060

To unfold the deepest layer of causes, the study needed to go beyond the contemporary history of South Africa's ocean economy and find an ultimate metaphor or myth behind the present situation and its social and cultural causes. The sustainability of South Africa's ocean economy was a result of a multitude of different stakeholders that developed a collective model for the future of all key sectors in the ocean space, and this was effectively supported by strategic investments in the key sectors, robust and adaptive business models especially for the emerging and underdeveloped areas within South Africa's ocean economy and strategies that promoted innovation in ocean economy industries and a supportive institutional environment.

Table 6.1: Causal and layered analysis in South Africa's ocean economy towards 2060

Level / Layer	Current	Emergent
Litany	Skills and new technologies are required within all six key ocean economy industries to enhance their services and the manufacturing of goods and products to be globally competitive.	Provide an integrated and sustainable ocean economy development that takes into account energy resources, climate change, food security technological innovations and the empowerment of local communities and women.
Systemic	Unethical leadership, interrupted power supply or power shortages and an inadequacy of the technological infrastructure in South Africa technological infrastructure to support sustainable ocean economy growth will probably create an unsupportive regulatory environment, which could negatively impact the growth of the sectors identified in the operation Phakisa Strategy.	Move away from unethical businesses and practices that are not focused on sustainability and building resilient ocean economies. Promote research and the sharing of knowledge on all key ocean economy sectors and encourage governments, businesses and communities to remain competitive and sustainable while growing their economies.
Worldview	Advances in information and communications technology and innovations will drive the inclusion of many communities and role-players in the ocean economy space.	Build long-term partnerships between government, businesses and local communities that will promote the implementation of key regional and national strategies on sustainable ocean economy development and co-create funding and innovative solution key for a competitive future.

Level / Layer	Current	Emergent
Myth / metaphor	South Africa is not fully-integrated into modern ocean economy industries (namely, aquaculture and alternative energy from wind or tidal energy). Food security and high reliance on imports further threaten high-value commercial locally-driven fisheries sector, which is necessary to contribute towards economic growth and sustainable development.	Encourage coordination and promote synergies across all ocean economy industries that are built on cutting edge innovation and ecosystems that will promote smart population, growing local communities and empowering women.

Source: Researcher's own construct.

Table 6.1 presented a CLA on South Africa's ocean economy using an integrated approach to all key six sectors, the environmental analysis and futures triangle provided in Chapter 4. The CLA, unlike other foresight techniques, has the ability to bring a different dynamic and richness to the innovation process that precedes the scenarios that are developed in Section 6.6.

6.6 SCENARIOS AS A TOOL TO CREATE ALTERNATIVE FUTURES FOR OCEAN ECONOMY DEVELOPMENT

Scenarios are said to deal with the core problems of a given futures study (Ratcliffe, 2000; Inayatullah, 2013). Individual trends do not automatically come together to create useful pictures of the future applicable to planning. A primary purpose of scenario building, therefore, is to create holistic, integrated images of how the future might evolve. These images, in turn, become the context for planning, a testing ground for ideas, or the stimulus for new development (Ratcliffe, 2000). The real-time Delphi method was another technique that was utilised to enhance the scenarios created. Using scenarios as a tool to explore plausible futures and support decision-making is called scenario analysis or scenario planning. Scenario planning first emerged in the 1950s through the work of Herman Kahn who, at the time, constructed scenarios in connection with military and strategic studies conducted by the US RAND Corporation (Glenn, 2009; Chermack, 2011).

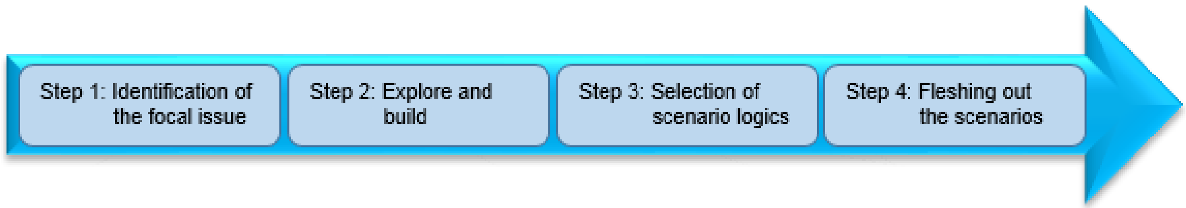
The creation of four scenarios is seen to stimulate more serious and flexible thinking about alternative possibilities for which flexible strategies would need to be created to adjust to changing futures (Glenn, 2009). Scenarios provide the ability for researchers to produce alternative futures based on a variety of assumptions, facts, trends and fields that require further understanding for a scenario project (Ratcliffe, 2000; Adendorff, 2013; Herbst & Mills, 2006). The goal of scenario planning is to provide several scenarios to researchers and decision-makers to allow them to better comprehend their options and possibilities (Adendorff, 2013). Ratcliffe (2000) summarises what various authors have regarded as the aim of scenarios in future studies. The prime aim of scenarios and scenario building is to enable decision-makers to detect and explore all, or as many as possible, alternative futures so as to clarify present actions and subsequent consequences (Ratcliffe, 2000; Chermack, 2011).

As highlighted in Chapter 2, the OECD (2016) developed two alternative scenarios, namely, sustainable growth and unsustainable growth, which could possibly shape the future of the ocean economy towards 2030 in two different directions, one accelerating, and the other slowing the future development of the ocean-based industries. The "sustainable scenario" assumes high economic growth and low environmental deterioration owing to the development of resource-efficient and climate-friendly technologies combined with a supportive governmental framework that provides the right incentives to allow the ocean economy to thrive economically while meeting environmental standards (OECD, 2016). The "unsustainable scenario" assumes low economic growth and serious environmental deterioration. Coupled with faster than expected climate change and low rates of technological innovation, the ocean economy experiences a challenging outlook beyond 2030 (OECD, 2016). The scenarios presented by the OECD (2016) provided a global outlook with very little focus on country specific challenges, strategies and trends. The OECD (2016) outlook anticipated that by 2030, the ocean-based industries in the business as-usual scenario would employ more than 40 million, representing more than 1% of the global workforce of around 3.8 billion people (including part-time, self-employed and unemployed people).

No specific scenarios have been developed for South Africa's ocean economy except for the OECD's (2016) baseline scenario, which assumes a continuation of past trends, no major policy changes, no abrupt technological or environmental developments, and no major shocks or surprises. The proposed scenarios for South Africa, presented in the study, took into consideration the complex ocean economy and the integrated approach needed to address social, technological, economic, environmental, political, legal and ethical dimensions for the country towards 2060.

The scenario building process followed for this research was a qualitative, exploratory scenario process, which was concerned with past and present trends and led to likely futures for South Africa's ocean economy towards 2060. The explorative scenarios considered the complex ocean economy environment and the key six industries identified as key in growing a sustainable ocean economy for South Africa. The proposed scenarios further took into consideration existing scenarios for South Africa as a country (Dinokeng scenarios and Indlulamithi scenarios), the scenario matrix developed by Claassen et al (2014) for South Africa's Maritime sector which took sector unification and technology uptake as key drivers, and the OECD's (2016) ocean economy scenarios towards 2030. The process that was followed is schematically presented in Figure 6.1; and it is discussed in more detail in Section 6.4.2.

Figure 6.1: Steps towards the explorative scenario building process



Source: Researcher's own construction.

Figure 6.1 provides a step-by-step approach on the scenario process followed towards building a scenario matrix for South Africa's ocean economy towards 2060. The approach starts with the identification of a focal point where the researcher critically engaged with the developmental role of the ocean economy and analysed existing facts within South Africa's ocean economy using an environmental scanning process, a futures triangle and a real-time Delphi process. The second step was mainly around building the scenarios and exploring the implications and views from key industry players that were knowledgeable and decision-makers in ocean economy matters in South Africa. With sustainability underpinned by socio-ecologic resilience, innovation and sustainable economic growth, these areas were most likely to shape the future of South Africa's ocean economy towards 2060 and were used as the axis upon which the eventual scenarios would differ. The thirds step which was the scenario logic used the identified axis and a scenario matrix was developed and tested, and the last step was on fleshing out the scenarios using a participative process. In this study, semi-structured interviews were used as a tool to flesh out the scenarios and link them with the literature review and findings in Chapters 4 and 5.

6.6.1 Qualitative scenario approach

Qualitative scenarios are used when the objective is to stimulate policy ideas, when communication and education is an important goal and when many views about the future have to be included (Ratcliffe, 2000). They are particularly useful in the analysis of complex situations with high levels of uncertainty as is the situation with the ocean economy. The preferred future for South Africa's ocean economy towards 2060, as well as a short description of the four scenarios, was presented to a purposefully sampled number of experts in the South African ocean economy. The semi-structured interviews were beneficial as the researcher could prepare the questions and send them to the confirmed participants ahead of time. Semi-structured interviews also allow informants the freedom to express their views in their own terms and provide reliable, comparable qualitative data. The criteria for inclusion was that the participants must be involved, at a national level, in research, strategic decision-making and the development of South Africa's ocean economy. Further to their involvement, the participants' level of influence and their collective ability to drive effective change in the South Africa's ocean economy (with regards to either innovation, governance or regulation) was also considered.

6.6.2 Description of the scenario steps

The chosen approach towards possible scenario for South Africa's ocean economy towards 2060 was based on the eight-step scenario method of Peter Schwartz (2007), as explained in his work "The art of the long view". The method made use of ten steps but has been customised and amended for this research to four steps as presented in

Figure 6.1. In the matrix technique, scenarios were narratives describing how things might be by a long-term time horizon, for example, South Africa's ocean economy towards 2060. Four scenarios were developed so as to represent different possible futures associated with a number of trends and events that described how the ocean economy for South Africa might develop.

Step 1: Identification of the focal issue

The identification of the central or focal issue step was important for identifying an issue(s) known to have a major impact, and where there were uncertainties about its impact over time. In this regard, the focal issues were linked to the megatrends identified in Chapter 5 and their strategic importance in driving the future of South Africa's ocean economy towards 2060.

Step 2: Explore and build

The qualitative approach of incorporating semi-structured interviews in the study was partially aimed at ranking the megatrends and exploring key areas of uncertainty that would form the basis for building the scenario matrix. The four corners of the basic scenario matrix for South Africa's ocean economy towards 2060, as presented in Figure 6.2, therefore, represent four possible logical futures that could be explored.

Step 3: Selection of scenario logics

The next critical step in scenario development was the identification of plausible storylines, which, according to Geldenhuys (2006), must portray the possible futures convincingly. These storylines were based on the outcomes of combinations of the most important and critically uncertain key-driving forces identified from the environmental scan and the real-time Delphi process. No creative storytelling, or names were used in this study, but the scenario matrix approach was used to identify the results of the ranking exercise in the previous step, which were, therefore, the axes along which the eventual scenarios differed (Schwartz, 2007).

Step 4: Fleshing out the scenarios

The final step was to construct a scenario for each of the combinations that convincingly presented a plausible scenario. In this regard, Geldenhuys (2006) and Schwartz (2007) suggest that the proposed scenarios must be based on those issues that are important to the focal issue. The fleshing out of the skeleton scenarios was then done by returning to the list of key factors and driving forces identified in steps two and three (Schwartz, 2007). The scenarios were then fleshed out in as much detail as possible, by focusing on the key factors and forces in each scenario (Geldenhuys, 2006; Schwartz, 2007).

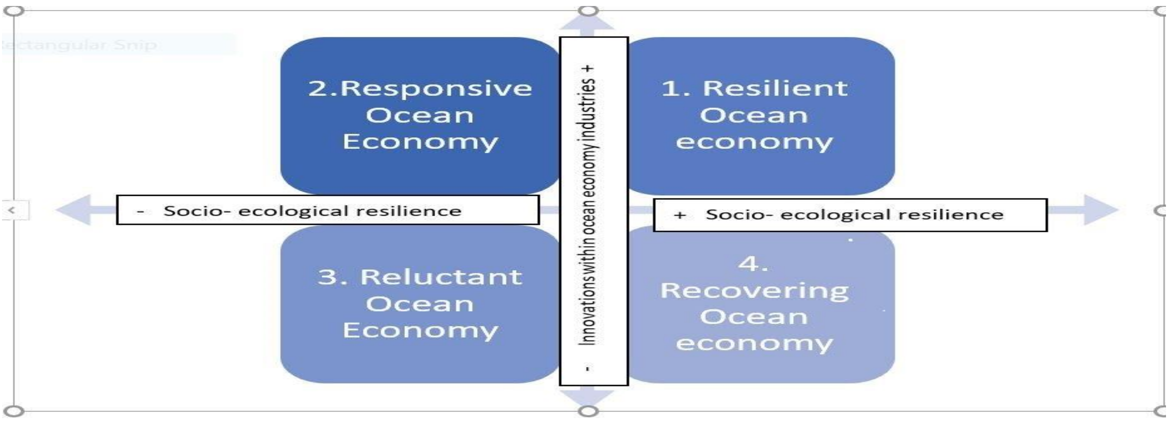
6.6.3 Development of the four scenarios

The scenario concept is based on the fundamental assumption that numerous different alternative futures are always possible and that scenarios have the purpose of spanning the space to be filled by possible futures. Scenarios, according to Kreibich et al (2011), may emerge from various processes. These may include scenario workshops, small expert groups, survey results, and the construction of scenarios based on different worldviews. The explorative scenarios present possible future scenarios with the present situation, informed by a literature review, the environmental scanning process and the real-time Delphi results, as a point of departure, towards a future for South Africa's ocean economy. The six ocean economy megatrends that had a high probability of being associated with a sustainable ocean economy for South Africa towards 2060 and the trends that were identified as key drivers and enablers in the ocean economy, as discussed in Chapter 4, and tested through the real time Delphi platform in South Africa formed the basis the scenario process. Owing to the complex nature of the ocean economy and the six ocean industries included in the study, the seven identified driving forces as tested in the real-time Delphi were summarised into two areas that formed as key inputs in the construction of the different scenarios, suitable for the development of a sustainable and an integrated ocean economy for South Africa towards 2060.

6.6.3.1 *Scenario matrix for South Africa's ocean economy*

The scenarios developed in the research illustrated how conditions for South Africa's ocean economy could develop and change towards 2060. The scenarios were based on the results of a comprehensive environmental scan (see Chapters 3 and 4) and the outcome of an online real-time Delphi survey (see Chapter 5). It addresses those changed areas, which were considered most likely to shape the future of South Africa's ocean economy towards 2060.The four corners of the basic scenario matrix for South Africa's ocean economy, as presented in Figure 6.2, represented four possible logical futures that could be explored. The horizontal axis of the scenario matrix represented socio-ecological resilience which was defined as the capacity to adapt or transform in the face of change in social and environmental aspects (this was linked to pandemic, education, environmental and ethical drivers in ocean economy development). The vertical axis in the proposed scenario matrix represented the level at which innovations in ocean economy sectors embedded themselves in the promoting sustainable ocean economies, resulting in high levels of productivity, inclusiveness and economic growth for South Africa towards 2060.

Figure 6.2: Proposed scenario matrix for South Africa's ocean economy towards 2060



Source: Researcher's own construction.

Scenario 1 (the quadrant where both socio-ecological resilience and innovations within ocean economy industries were highly-embedded), represented a resilient ocean economy for South Africa characterised by a dominant focus on improved socio-economic standards and preservation of the natural resources and biodiversity through a coordinated and integrated ocean economy. Resilience was an integrative concept, characterised by positive outcomes that promoted inclusive and sustainable growth and well-being. This focus was supported by policies and legislation that promoted an inclusive sustainable ocean economy that innovatively utilised innovation and new technologies to strategically partner with multiple stakeholders and role-players across all ocean economy industries.

Scenario 1:

South Africa has a resilient ocean economy that focuses on improved socio-economic stands and innovation across all key six ocean economy industries

Scenario 2 (the quadrant where socio-ecological resilience was poorly-embedded and innovations within ocean economy industries were highly-embedded), represented a responsive ocean economy for South Africa characterised by a dominant focus on innovation to respond and catch up with global trends at the expense of socio-economic standards that promoted equality, inclusivity and sustainable use of natural resources within ocean economy industries. All key ocean economy sectors would be quick to want to adopt and implement global trends and innovations that promoted growth even if a balance was not maintained around inclusivity and sustainable use of natural resources within ocean economy industries.

Scenario 2:

South Africa has a responsive ocean economy with a dominant focus on innovation

Scenario 3 (the quadrant where both socio-ecological resilience and innovations within ocean economy industries were poorly-embedded), represented a reluctant ocean economy for South Africa characterised by a dominant focus on inequality and poor socio-economic standards. Innovations on ocean economy industries wound not be informed by research and development unique to South African conditions and the technologies would be expensive and inaccessible for majority of the coastal communities and role-players that would like to promote a sustainable, ethical and an inclusive ocean economy.

Scenario 3:
South Africa has a reluctant economy with a focus on inequality and poor socio-economic standards

Scenario 4 (the quadrant socio-ecological resilience was highly-embedded and innovations within ocean economy industries were poorly-embedded), represented a recovering ocean economy for South Africa characterised by a dominant focus on socio-economic standards that promoted equality, inclusivity and sustainable use of natural resources within ocean economy industries. Innovation and technologies that could compete on a global scale would not be developed, lack of research and development and investments on innovations within all ocean industries would not allow for the country to fully explore its vast coastline and generate the necessary economic growth attributed to a sustainable ocean industry.

Scenario 4:
South Africa has a recovering ocean economy with a dominant focus on promoting socio-economic standards

6.6.3.2 Semi-structured interviews and the linkage between the qualitative scenario process

As cited in Chapters 1 and 2, the study made use of a sequential mixed method research approach that was predominantly qualitative. The real-time Delphi process completed in Chapter 5 was key for confirming the six megatrends in the ocean economy and key drivers and enablers that continued to shape the South African ocean economy industry. The results from the real-time Delphi and findings discussed in Chapter 5 were key for the interview guideline and the build-up to the scenarios identified for South Africa's ocean economy towards 2060.

A purposive sample of 12 participants in South Africa, that were key role players in the ocean economy were invited to participate in the semi-structured interviews. Chapter 2 explained that the criterion for inclusion was that the participants must be high-level ocean economy practitioners and decision-makers with in-depth knowledge of South Africa's ocean economy and a good understanding of the global ocean economy. The participants were contacted via email inviting them to participate in the study and a background to study and an interview guide was shared upon signed consent (see Appendix 3). The interview sessions were scheduled via an online Microsoft Teams platform, for a duration of 30 minutes where participants were asked to comment on South Africa's ocean economy and identify a possible scenario for South Africa's ocean economy, based on their knowledge and expertise and the scenario matrix (see Figure 6.2). Table 6.2 summarises the feedback on the identified scenarios.

Table 6.2: Summary of responses from semi-structured interviews on the scenarios

Participants	Scenario 1: A resilient ocean economy	Scenario 2: A responsive ocean economy	Scenario 3: A reluctant ocean economy	Scenario 4: A recovering ocean economy
Participant 1	The country is not impacting the ocean, from a human impact or footprint on the ocean space, except for the fishing activities in the West Coast. An underdeveloped and untapped ocean economy can promote ecological resilience, but from an economic growth perspective South Africa will need grow the necessary knowledge and skills needed to sustainably explore its oceans.	The second scenario might not be possible for South Africa's ocean economy, except for the constrained fishery sector in the Western Coast. Other sectors will never be responsive as they are not fully explored and exploited by all provinces.	Technology and awareness will be key in addressing inequality and promoting socio-economic growth. If these are not addressed this scenario will never be applicable as inequality will persist.	South Africa does not use its ocean space in terms of the entire EEZ and high seas adjacent to its water. The country's impact on the ocean economy and all its sectors is making this scenario less feasible for South Africa's future.
Participant 2	The country needs to do a lot to achieve a resilient ocean economy. Technology and skills need to be built, and an integrated approach for the country's ocean space is needed.	South Africa's ocean economy will grow slowly owing to the investment challenge and the capital-intensive nature of innovations needed for a sustainable ocean economy, in the face of a weak rand to dollar exchange. The country will be slow to respond and catch up with global trends.	South Africa has institutions and activists that are watching and willing to promote a sustainable ocean economy. These role-players, institutions and interest groups will be key in promoting and making sure that our ocean economy is sustainably explored and not exploited.	Scenario 4 would be a realistic plot of SA's ocean economy owing to the slow recovering ocean economy for South Africa characterised by a dominant focus on socio-economic standards that promote equality and policies that might delay rapid innovation and ocean economy development.

Participants	Scenario 1: A resilient ocean economy	Scenario 2: A responsive ocean economy	Scenario 3: A reluctant ocean economy	Scenario 4: A recovering ocean economy
Participant 3	Infrastructure and investments remain key in plotting South Africa at scenario 1 and our government is showing a level of responsiveness as we have seen with the hydrogen fuel initiatives and TNPA's restructuring as per the National Ports Act of 2008.	Education, research and innovation to respond and catch up with global trends are key but they should not happen at the expense of socio-economic standards that promote equality, inclusivity and sustainable use of natural resources within ocean economy industries. We have hungry people in most of the rural coastal communities in our country and our ocean economy should assist with growth and food security.	In realising a reluctant ocean economy and addressing inequality and poor socio-economic standards, education will remain key for South Africa's youth and local communities.	Maintaining a balance from the various needs that South Africans have and the competing demands for the ocean, a coordinated and a collaborative approach will be needed for the sectors that are over exploited like fishing. A dominant focus on socio-economic standards that promote equality, inclusivity and sustainable use of natural resources within ocean economy industries will be key for a reluctant ocean economy, even if innovation is slow.
Participant 4	Scenario 1 is very crucial and more realistic because as South Africa innovates, the closer it gets to the ocean and it is realised that humanity can be served through sustainable ocean industries (whether it is through food, transportation or coastal and marine tourism).	South Africa does need to catch up with global trend realise the aspirations and from international bodies and the regional strategies while promoting equality, inclusivity and sustainable use of natural resources.	The reason why South Africa has Operation Phakisa and the MSP process as key strategies and tools that promote a better understanding of the ocean and economic growth, a reluctant ocean economy that is characterised by a dominant focus on inequality and poor socio-economic standards will kill the good efforts that the country is making.	Resilience and innovation in the ocean economy will be very important as a driving factor of a sustainable ocean economy. A rapidly recovering and transparent ocean economy for South Africa characterised by a dominant focus on socio-economic standards that promote equality, inclusivity and sustainable use of natural resources within ocean economy industries will be key for peace and growth.

Participants	Scenario 1: A resilient ocean economy	Scenario 2: A responsive ocean economy	Scenario 3: A reluctant ocean economy	Scenario 4: A recovering ocean economy
Participant 5	The first scenario is more needed for the country as innovations and improved social and environmental standards are key for a sustainable ocean economy but that is not realistic. Improved socio-economic standards and preservation of the natural resources and biodiversity through a coordinated and integrated ocean economy will be key in harnessing and building our ocean economy.	The base for South Africa's ocean economy is a natural resource base and it has been that way for the past 50 years. A dominant focus on innovation to respond and catch up with global trends at the expense of socio-economic standards that promote equality, inclusivity and sustainable use of natural resources within ocean economy industries might be unrealistic as the country will always play it safe when it comes to ocean economy. development.	South Africa lacks investment and sustainable ways of promoting mixed and complementary industries and activities in the ocean economy. South Africa rather focuses on inequality and poor socio-economic standards. Innovations on ocean economy industries will be expensive and inaccessible for the majority of the coastal communities and role-players that would like to promote a sustainable, ethical and an inclusive ocean economy.	Co-existence of all the various ocean economy industries will be a key driving factor towards a sustainable ocean economy. Innovation and technologies that can compete on a global scale will not be developed, lack of research and development and investments on innovations within all ocean industries will not allow for the country to fully explore its vast coastline, making it a recovering ocean economy for many years.
Participant 6	For scenario 1 and the focus on resilience being an integrative concept, characterised by positive outcomes that promote inclusive and sustainable growth and well-being. South Africa will not do well in realising this vision as they are comfortable with being linear, less adoptive and innovative. For example, why can't the country integrate aquaculture fish farms and tourism as they are successfully integrated in other parts of the world.	The country will realistically be in scenario 2. South Africa is a country with a new democracy and pleasing everyone will be a challenge. Promoting a responsive ocean economy that builds equality, inclusivity and sustainable use of natural resources within ocean economy industries might be a challenge considering the diverse groups and challenges faced by this young democratic country that has a wide inequality gap.	A reluctant ocean economy for South Africa characterised by a dominant focus on inequality and poor socio-economic standards might not be achievable as the country is not integrated in its implementation and access to information for local communities is the key challenge.	A recovering ocean economy for South Africa characterised by a dominant focus on socio-economic standards that promote equality, inclusivity and sustainable use of natural resources within ocean economy industries will be a challenge as the country lacks in terms of building and maintaining a competitive and comparative advantage for most of its ocean economy industries.

Participants	Scenario 1: A resilient ocean economy	Scenario 2: A responsive ocean economy	Scenario 3: A reluctant ocean economy	Scenario 4: A recovering ocean economy
Participant 7	Building natural capital and creating satellite accounts are essential for the country's ocean economy as this may improve socio-economic standards and preservation of the natural resources and biodiversity through a resilient, coordinated and integrated ocean economy.	The second scenario (responsive ocean economy) is more realistic for South Africa as we have the necessary biodiversity and climate change strategies in place. What we need to work on as a country is the economic growth and innovation side of things.	Inequality and poor socio-economic standards will continue if we do not grow our GDP and employment prospects across all key ocean industries and regions in the country. Innovations on ocean economy industries will not be informed growth and research will not be translated into solutions without the necessary funding strategies and sources.	This scenario will prevail if we understand the economic value and cost benefits from the ocean industries as South Africa will have a dominant focus on socio-economic standards that promote equality, inclusivity and sustainable use of natural resources.
Participant 8	Is South Africa providing the necessary infrastructure and knowledge sharing platforms that promote resilience? As an integrative concept, characterised by positive outcomes that promotes inclusive and sustainable growth and well-being, achieving this scenario might be a challenge as most role-players are reluctant to invest in growing this sector.	South Africa is caught between scenario 2, a responsive ocean economy and scenario 3, a reluctant ocean economy. The plans and discussions have been documented around the socio-ecological resilience that also promotes economic growth and the innovation that the country needs to grow and sustain the ocean economy. Yet the country is not providing the infrastructure and funding required to grow a competitive and a sustainable ocean economy.	Investment is key for growing a reluctant ocean economy characterised by programmes and projects that address inequality and poor socio-economic standards. In the absence of this, the scenario will not be possible for South Africa.	Resistance to environmental protection and slow incorporation of innovation and technologies will delay the realisation of a responsive ocean economy with a dominant focus on socio-economic standards that promote equality, inclusivity and sustainable use of natural resources.

Participants	Scenario 1: A resilient ocean economy	Scenario 2: A responsive ocean economy	Scenario 3: A reluctant ocean economy	Scenario 4: A recovering ocean economy
Participant 9	Knowledge and the transfer of skills will be very crucial as we promote a resilient ocean economy and have a dominant focus on socio-economic standards that promote that promote inclusive and sustainable growth and well-being.	South Africa's ocean economy is mainly driven by two key departments. The country is at times found wandering and hence, in the absence of a champion, we will always find the country either in the second scenario, where we are always responsive and catching up with the rest of the world.	Yes, the necessary capacity and support does exist, but we are more users in the country versus investors in growing our ocean economy. We also struggle to translate what we learn at universities into real income opportunities and link it to the system for various growth prospects in ocean economy industries.	The scenario is possible and South Africa can have a recovering ocean economy characterised by a dominant focus on socio-economic standards that promote equality, inclusivity and sustainable use of natural resources within ocean economy industries. But the response rate and productivity in the country is a problem. We also don't realise the vast natural resources that we have and how they can be translated into competitive economies.

Source: Researcher's own construction.

Considering the results in Table 6.2, of the nine respondents, five respondents identified Scenario 1 as the most realistic and needed for a sustainable ocean industry towards 2060. Three of the respondents plotted South African in-between Scenario 2 and Scenario 4 and one participant identified the country at possibly Scenario 3, which was characterised by a reluctant ocean economy. Braun and Clarke (2006:79) define thematic analysis as a "method for identifying, analysing and reporting patterns within data". The common themes in the qualitative analysis of the responses of the participants on the proposed scenarios is that South Africa's ocean economy towards 2060 could be plotted under Scenario 1. The scenario signifies a resilient ocean economy for South Africa characterised by a dominant focus on improved socio-economic standards and preservation of the natural resources and biodiversity through a coordinated and integrated ocean economy. As illustrated in Chapter 4, South Africa's ocean economy spans a number of different sectors, with significant potential synergies, provides positive incentives for moving towards better integrated legal, regulatory, and institutional frameworks (UNECA, 2016). Before the MSP (2017) and Operation Phakisa (2014) was implemented, there was no overall system in place to guide ocean governance, and marine resources were managed sectorally. The coordinated efforts at a national level and the information made available on sustainable use of ocean resources could capitalise on the use of the vast coastline South Africa has and promote development opportunities that could promote sustainable development across all ocean economy industries.

6.6.4 Capacity and support for the preferred scenario for South Africa's ocean economy

The ocean economy is complex and is characterised a number of policies, legislation and guidelines that are international, regional and national or transnational. The notion of capacity and support for a sustainable ocean economy that promotes integration and cooperation within the various ocean economy sectors is very important. Table 6.3 provides an overview as to what the participants viewed as the current capacity and support and whether the tools, measures and instruments in place could achieve sustainable development for South Africa's ocean economy.

Table 6.3: Capacities and support in South Africa's ocean economy industries and institutions

Participant	Response on capacities and support that exist in South Africa's ocean economy space
Participant 1	The planning, capacity and the ideas needed to grow the ocean economy are there and what needs to follow is the implementation. Investments in the harbours and ports is happening and forward planning in terms of the MSP and promoting inclusivity is there, but on a very slow pace.
Participant 2	South Africa has the capacity and it has mature institutions and activists that are watching and willing to promote a sustainable ocean economy. With the government wanting to advance and grow the ocean economy, the energy challenge will need to be addressed through a public private partnership and through a phased approach, if we are to have a net zero carbon emission in 2050 in key ocean economy sectors (namely, oil and gas, shipping, coastal and marine tourism).
Participant 3	The necessary capabilities, skills and knowledge do exist in South Africa and the institutions that are key for ocean economy development. The absence of a champion through a ministry of ocean economy or a department that will look at the coordination and integration of all six ocean economy sectors, will cause problems for South Africa going into the future
Participant 4	Yes, we have the necessary capacity and instruments. Take Operation Phakisa and the MSP process as an example, those are key strategies and tools that promote a better understanding of the ocean and what it can offer the country.
Participant 5	Yes, the necessary capabilities and support do exist in South Africa, but more focus needs to be placed on investment and sustainable ways of promoting mixed and complementary industries and activities in the ocean economy.
Participant 6	Yes, the necessary capacity and support does exist, but we are yet to identify our nationwide competitive advantage for the ocean economy and leverage on that.
Participant 7	Yes, the necessary capabilities and support do exist in South Africa, we have the relevant policies and good research that informs our policies and plans.
Participant 8	Yes, South Africa has good policies and well capacitated individuals and institutions to grow the ocean economy. The current challenge is a passive investment strike that the country is currently experiencing.
Participant 9	Yes, the necessary capacity and support do exist, but we are more of users in the country versus investors in growing our ocean economy. We also struggle to translate what we learn at universities into real income opportunities and link it to the system for various growth prospects in ocean economy industries.

Source: Researcher's own construction.

Table 6.3 responds to the notion of capacity and support in realising a sustainable ocean economy for South Africa towards 2060. The common themes identified by the participants was that South Africa had good policies and well capacitated individuals and institutions to grow the ocean economy, but it urgently needed a champion to glue the strategies and concerted investment efforts.

6.6.5 Additional comments on research aimed at building scenarios for South Africa's ocean economy

In analysing key component of the global development agenda and developing scenarios for South Africa's ocean economy and as part of research and qualitative enquiries, it is important that the researcher gained additional views and comments, over and above what the interview guideline provided from knowledgeable industry experts and decision-makers, on key areas for consideration as the study concluded and proposed an integrated vision for the ocean economy. Table 6.4 provides a highlight of the responses of the participants when asked to add any additional comments or areas that were crucial for the sector and sustainable development.

Table 6.4: Highlights from additional comments made by the participants

Participant	Additional comments made key to the research
Participant 1	With South Africa having three primary oceans and coasts acts and legislation (MSP, ICM and MLRA) and looking at the history of shipping and fishing in the country, we have several areas that remain untapped (namely, water desalination from the ocean, wind and tidal energy). Water desalination is the process of extracting water from the ocean, through a marine intake pipeline and seawater pumping system, the brine is discharged through a system to separate the salt and water and an additional injection system is used to convey the fresh water to the localised water infrastructure network.
Participant 2	No additional comments, except that a more collaborated and multisectoral approach is needed in promoting a sustainable ocean economy.
Participant 3	Maintaining a balance from the various needs that South Africans has and the competing demands for the ocean, a coordinated and a collaborative approach will be needed.
Participant 4	How the country approaches development in the ocean economy will be very important as a driving factor of a sustainable ocean economy. A collaborated and an integrative cluster approach as it is done in other European countries, will be a key driving factor.

Participant	Additional comments made key to the research
Participant 5	An overall holistic approach, as commanded by the 17 Sustainable Development Goals, that promotes that co-existence of all the various ocean economy industries will be a key driving factor towards a sustainable ocean economy.
Participant 6	A champion or a key government department or state-owned enterprise that will glue all the ocean-based industries will be key for a sustainable ocean economy.
Participant 7	Natural capital and creating satellite accounts are essential for the country's ocean economy. We also have various economic models that are being tested and that have the potential to grow a sustainable ocean economy, grow our GDP and provide the needed employment.
Participant 8	The time horizon for the study (towards 2060), which moves a decade from the 2050 Africa Integrated Maritime Strategy and the EU 2050 blue ocean economy strategy is a good target as it allows the study to analyse and also expand on the 2030 and 2050 targets that were never included or might not be attainable in terms of relevance and the economic well-being of coastal areas.
Participant 9	The country needs to move away from the user mentality or role and become real inhabitants of the country that will also invest and want to grow the ocean economy. Knowledge and the transfer of skills will be very crucial as we more to the investor role.

Source: Researcher's own construction.

The additional comments highlighted in Table 6.4 showed that there was a large need for economic growth and a champion to drive the integrated sustainable ocean economy process for South Africa if it wanted to be sustainable towards and beyond 2060. Investments to grow a sustainable ocean economy and the GDP remained crucial for a sustainable ocean economy. A leader or a champion was needed in driving a holistic and integrated sustainable ocean economy. The initiatives, across all six sectors, that were being implemented at various levels within government, the private sector, academia and coastal communities would not yield the required results and address the notion of innovation, increased knowledge and promote equality if not properly coordinated. Economic development and economic growth were at a minimum, where South Africa had struggled to sufficiently recover from several recessions. There was low international investment demand as FDI stagnated and failed to promote economic growth and infrastructure development.

The common themes identified from the qualitative responses were key for the development of a probable future for South Africa's ocean economy towards 2060. The four themes are expanded on in Section 6.6 are key in the development of scenarios for South Africa's ocean economy towards 2060.

6.7 SCENARIOS AND DEVELOPMENT OF AN INTEGRATED VISION FOR SOUTH AFRICA'S OCEAN ECONOMY TOWARDS 2060

While planning intends to control and close the future, through the development of scenarios several plausible narratives about the future are constructed. As highlighted in Chapter 2, futures studies are committed to the creation of authentic alternative futures (Inayatullah, 2013). The use of the future, as one of Inayatullah's (2013) basic concepts of futures thinking, therefore implies a much more action-oriented process. As an executive function, it has the ability to influence and enhance strategic decision-making. The main research question for the study was, what should a scenario for South Africa ocean economy look like towards 2060? The study aims to address the main research question by developing a long-term integrated vision towards 2060 for South Africa's to achieve its long-term ocean economy development goals.

The proposed vision for South Africa's ocean economy is captured as:

> *Mitigate against future challenges, collaborate and proactively utilise the development opportunities that are offered by the ocean economy.*

A national vision needs to represent the goals and objectives of society, while providing a sense of purpose for the nation and those that are trying to achieve the best-possible scenario for South Africa's ocean economy towards 2060 (Adendorff, 2013). The proposed national integrated vision is discussed further in Chapter 7. It depicts a realistic, achievable and sought-after future that could form the foundations of any national development plan that is associated with the strategic future of a sustainable ocean economy that optimally explores all ocean economy industries.

6.8 PROMOTING THE USE OF SCENARIOS IN SOUTH AFRICA'S OCEAN ECONOMY

As highlighted in Chapter 2, Vervoort et al (2014) identified three challenges to the development and use of scenarios by decision-makers, namely, appropriate scope for action, continuously engaged stakeholders and capacity development for decision-makers and their organisations. The consultation process with the purposively sampled participants was a semi- structured interview session. Despite the interviews been held once, participants were given the questions in advance for preparation, and the findings of the study would be shared upon finalisation. This was an initiative to engage ocean economy stakeholder and promote capacity development for decision-makers and their organisations within the South African ocean economy sectors and departments.

Studies that have previously developed scenarios for South Africa's ocean economy are few and their focus has been on developing South Africa as a whole and not specifically geared around the ocean economy sector. The Dinokeng scenarios were developed in 2008 and finalised in 2009 to take stock of where South Africa was and to consider possible futures for South Africa in its efforts to advance democracy and grow the economy of the country. The challenge for South Africa, at that time, was that it had failed, as a country, to appreciate or understand the imperatives of running a modern democratic state. Leadership across all sectors lacked clarity of purpose and was increasingly becoming self-interested, unethical and unaccountable (The Dinokeng Scenarios, 2009). The three scenarios identified for South Africa in 2009 were:

a) In the first scenario, "we Walk Apart", the state becomes increasingly weak and ineffective. A disengaged and self-protective citizenry eventually loses patience and erupts into protest and unrest. The state, driven by its inability to meet citizen demands and expectations, responds brutally and a spiral of resistance and repression is unleashed.

b) In the second scenario, "we Walk Behind", the state becomes increasingly strong and directive, both enabled by and enabling a civil society that is increasingly dependent and compliant. The state grows in its confidence to lead and direct development. However, it does not by itself have the capacity to address critical challenges effectively. The demands of socio-economic development and redistributive justice amid a global and domestic economic crisis place strain on the state's capacity to deliver to all and to be all. These strains are most evident in the declining ratio between revenue and expenditure. In the worst case, the state over-reaches and is forced to borrow from multi-lateral financial institutions. As a result, South Africa loses the ability to determine its own social spending agenda.

c) In the third scenario, "we Walk Together", tells the story of a state that becomes increasingly catalytic and collaborative; of an enabling state that listens to its citizens and leaders from different sectors; a state that engages with critical voices, that consults and shares authority in the interest of long-term sustainability. This is also a story of an engaged citizenry that takes leadership and holds government accountable, a citizenry that shares responsibility for policy outcomes and development. This is not an easy path as the outcomes are open and are vulnerable to manipulation by stronger actors. However, the alliances, pacts and partnerships required to address the challenges could be too slow and weak to be effective.

The Indlulamithi South Africa Scenarios 2030 were launched in June 2018 and finalised in 2019 as a multi-stakeholder, research driven initiative to provide tools in the form of scenarios to focus leaders from different sectors and people from all walks of life on a key question, namely, what would a socially cohesive South Africa look like? The Indlulamithi (2019) process presented three scenarios, which expressed the ways in which South Africa might develop:

a) Nayile Walk (A nation in step with itself): In a precise sequence of steps, Nayile Walk choreographs a vision of South Africa where growing social cohesion, economic expansion and a renewed sense of constitutionalism get South Africa going.

b) iSbhujwa (An enclaved bourgeois nation): Epitomising a loose-limbed, jumpy nation with a frenetic edge, iSbhujwa is a South Africa torn by deepening social divides, daily protests and cynical self-interest.

c) Gwara-Gwara (A floundering false dawn): In a nation torn between immobility and restless energy, Gwara-Gwara embodies a demoralised land or disorder and decay.

In linking the Dinokeng and Indlulamithi scenarios with the proposed ocean economy development scenarios and selecting a scenario that would promote sustainable ocean economy development, namely, the Walk Together Dinokeng scenario. This scenario tells the story of a state that becomes increasingly catalytic and collaborative; of an enabling state that listens to its citizens and leaders from different sectors; a state that engages with critical voices, that consults and shares authority in the interest of long-term sustainability. As a result, The Walk Together scenario would be more suitable and relevant for promoting an integrated and a sustainable ocean economy.

6.9 STRATEGIC ELEMENTS AND ENABLING FACTORS FOR A SUSTAINABLE OCEAN ECONOMY FOR SOUTH AFRICA TOWARDS 2060

From a developmental perspective, the key purpose of developing scenarios for South Africa's ocean economy was to highlight the central elements when analysing and knowing the alternative futures that might characterise the ocean economy, and to draw attention to the key factors that would drive future developments (Kreibich et al, 2011). As a result, the proposed scenarios built on the megatrends, wild cards or disruptive events, which could then be incorporated into long-range planning for ocean economy development. The scenarios for South Africa's ocean economy towards 2060 were narrowed to the preferred future. To ensure a holistic approach, it is necessary to answer the strategic questions of What to do? and How to do it? In this regard, the study identified three broad priority elements that needed to be addressed:

- Element 1: Investment in education / research and adoption of innovative solutions in growing the ocean economy.
- Element 2: Collaborative relationships between ocean economy role-players.
- Element 3: Facilitation of sustainable ocean economy development that is facilitated through policy and partnership.

Taking into consideration these three mentioned elements, the need for South Africa to balance the social, technological, economic, environmental, political and ethical dimensions of sustainable development in relation the country's ocean is a key component in promoting a sustainable ocean economy for South Africa (Adendorff &Collier, 2015; World Bank et al, 2017). The three strategic elements are further discussed in Chapter 7 under an integrated vision for a preferred ocean economy. In the coming decades, scientific and technological advances are expected to play a crucial role in addressing many of the ocean-related environmental challenges facing South Africa and Africa (Mare, 2012; Adendorff & Collier, 2015; OECD, 2016). The environmental and social impacts upon each of the African (established or the emerging) marine industries, as well as their potential economic benefits, are unique to each of the countries of the continent, South Africa, in particular (Adendorff & Collier, 2015; World Bank et al, 2017). All industries within South Africa's ocean economy need to leverage their competitive advantage of size / making use of the vast coastline that the country has, making better use of technological innovations to grow its network and customer base to provide solutions through innovative ocean economy industries.

6.10 SUMMARY

The clarifying scenarios were about their future context and how to use this context to inform what to do in the present. A causal layered analysis (CLA) was also presented to understand the litany, the systematic, the worldview and the metaphors key for deepening the scenarios for South Africa's ocean economy towards 2060.The scenarios developed in the chapter and the strategic elements identified for a sustainable ocean economy for South Africa towards 2060 were key for informing and shaping present behaviour and strategies. The preferred scenario for South Africa's ocean economy was formed in the quadrant where both the two main driving forces were deeply-embedded, and this was tested through a semi-structured interview process. The process in Chapter 6 further enabled new thinking to emerge that had the potential for forward-thinking executives and decision-makers to significantly increase their innovation to co-evolve a desired emerging future as it occurred in the here-and-now to enhance strategy, which was key for a sustainable ocean economy development. In Chapter 7, a preferred future for South Africa's ocean economy is developed by expanding on an integrated vision and offering practical guidelines for the key ocean economy sectors for South Africa's strategy.

CHAPTER SEVEN

AN INTEGRATED VISION FOR A SUSTAINABLE OCEAN ECONOMY FOR SOUTH AFRICA TOWARDS 2016

7.1 INTRODUCTION

Chapter 6 provided key definitions regarding scenarios and scenario planning and the purpose thereof, as well as the value in development planning with specific focus on South Africa's ocean economy towards 2060. In this chapter, the scenarios identified in Chapter 6 are narrowed into an integrated vision that could possibly promote a sustainable future for South Africa's ocean economy towards 2060. Chapter 7 first provides a summary of South Africa's ocean economy and expands on an integrated vision for the ocean economy in South Africa as introduced in Chapter 6. Chapter 7 further presents practical guidelines to address the issue of a sustainable ocean economy for South Africa towards 2060. Chapter 6 was crucial for the study qualitatively in developing and discussing the scenarios. Chapter 7 also presents an integrated vision for South Africa's ocean economy with the ultimate aim of using the literature review in Chapters 3 and 4 and the data collected in Chapters 5 an 6 to respond to the main research objectives. These were aimed at exploring and providing guidelines on alternatives for South Africa's ocean economy towards 2060 by considering the six key ocean sectors as outlined in the 2014 Operations Phakisa Strategy.

7.2 SUMMARY OF SOUTH AFRICA'S OCEAN ECONOMY

As highlighted in Chapter 1, if fully-exploited and well-managed, South Africa's ocean economy could create a major source of wealth and propel the country's fortunes (United Nations Economic Commission for Africa (UNECA), 2016). As highlighted in Chapter 4, South Africa's ocean ecosystems faces irreparable damage unless human activities are better regulated, and marine life is protected through better governance (Walker, 2018). From the environmental scan process conducted on the South African economy in Chapter 4, it was evident that South Africa had chosen the oceans as a site for major investments and activities designed to tackle some of the unemployment and low growth trajectory in a number of coastal regions within the country. This was not a simple process as the implementation of the Operation Phakisa Strategy introduced in 2014 had not realised the anticipated growth levels. Being a developing country, South Africa still faced challenges dealing with the consequences of population growth outgrowing economic growth, a widening inequality gap and rising unemployment figures. Adendorff and Collier (2015) highlight some key implications for South Africa and Africa, namely, a shortage of freshwater, increasing food insecurity, deforestation, accelerated depletion of scarce, natural resources leading to higher commodity prices, slowed progress in improved child and maternal health as well as an increase in global Greenhouse gas emissions. These implications linked with some of the 15 global challenges discussed in Chapter 3, and as they remained key, they should be taken into consideration when developing a vision for the ocean economy.

It has been five years since the introduction of Operation Phakisa's (2016) *ocean economy* and considerable milestones were achieved to grow the aquaculture sector. During 2019, in the Operation Phakisa plan targets, a total investment of R2.8 billion (government and private) since 2014 was required to unlock an additional 2 618 direct jobs, 20 970 tons production capacity and increase turnover across the 36 projects to over R1.6 billion per annum (Department of Environmental Affairs, 2020).

7.3 KEY SUCCESS FACTORS FOR A SUSTAINABLE OCEAN ECONOMY

With only nine years until 2030, the deadline for achieving the United Nations Sustainable Development Goals (SDGs), the world has set itself an ambitious task in meeting the targets identified in the 17 SDGs as highlighted in Chapters 3 and 4. On the SDG around the ocean, SDG 14 countries would have to produce innovatively and sustainably from ocean resources to reach the SDGs. South Africa needs the oceans to provide more food, more jobs and more energy as shown in the Operation Phakisa Strategy (Department of Environmental Affairs, 2014), and the country must maintain its capacity to regulate the climate and support biodiversity. These are all reasons to manage the ocean economy better. To build a sustainable ocean economy, coastal communities and users must stop the degradation of the world's marine ecosystems and improve the environmental status of the oceans. This would require action from all ocean economy industries and role-players.

The WEF report (2019) demonstrates that sustainable use of the oceans has laid the foundation for many countries prosperity and the welfare of their population (for example, Norway, Sweden, Singapore and Mauritius), and the ocean economy has the potential to solve some of the most challenging issues facing the world today. For example, eradicating hunger and extreme poverty by 2030, fighting disease and pandemics, combating climate change, creating jobs in both developed and developing countries, ensuring affordable and clean energy for all and even securing peace and stability.

In identifying and proposing key success factors for South Africa's ocean economy towards 2060, a holistic approach that incorporated the priority elements identified in Chapter 6, Section 6.8 needed to be addressed towards growing and promoting a sustainable ocean economy. This holistic approach is presented in Table 7.1 for all the key ocean economy sectors for South Africa.

Table 7.1: Holistic approach based on priority elements for a sustainable ocean economy

Key ocean economy sectors and sustainability towards 2060	**Element 1: Investment in education / research and adoption of innovative solutions in growing the ocean economy.**	**Element 2: Collaborative relationships between ocean economy role-players.**	**Element 3: Ocean economy development facilitated through policy and partnership.**
1. Marine transport and manufacturing 2. Offshore oil and gas exploration 3. Fisheries and aquaculture 4. Marine protection services and ocean governance 5. Small harbours development 6. Coastal and marine tourism	• Cutting edge and well-resourced institutions that would drive research, skills development and education. • Promoting innovations and technologies that would translate natural resources and minerals available in South African waters for all ocean economy sectors, especially those related to fishing, oil and gas as well as coastal and marine tourism.	• Having credible role-players that would promote collaboration, the involvement of local communities, women and youth in shipping, ports and manufacturing.	• Implementing key policies and partnerships aimed at sustainable ocean economy growth, world class marine transport facilities and manufacturing capabilities.

Source: Researcher's own construct.

The key success factors for South Africa's ocean economy towards 2060 highlighted in Table 7.1 were integrated for all six key ocean economy industries not only for identification, planning and evaluation purposes, but also for suggesting and encouraging a holistic approach that incorporated and promoted a sustainable ocean economy towards 2060.

7.4 AN INTEGRATED VISION FOR SOUTH AFRICA'S OCEAN ECONOMY TRANSFORMING THE FUTURE

Kreibich et al, (2011) and The Forward-Thinking Platform (2014) as cited in Oberholster (2017) state that scenario development and future studies acknowledge the guiding role of envisaging in the process of knowledge creation. In introducing a vision for South Africa's ocean economy towards 2060, it is important to highlight the regional vision as contained in the AIM 2050 Strategy. The overarching vision of the 2050 AIM Strategy is to foster increased wealth creation from Africa's oceans and seas by developing a sustainable thriving blue economy in a secure and environmentally sustainable manner.

The Forward-Thinking Platform (2014:4) describes a vision as a "compelling image of a usually preferred future, with a visage that is described as the process of creating a series of images or visions of the future". A key element of using and assessing Inayatullah's (2004) six pillars to future studies was, therefore, to not only review the ocean economy and strategies for growth and sustainability, but also to depict a vision for South Africa's ocean economy towards 2060. The importance of creating a vision was to also include in the research sub-question (SQ6) of "What are the key components of the global development agenda and how does the preferred scenario promote a sustainable ocean economy for South Africa?" This vision not only expanded on promoting biodiversity and economic opportunities but also acted as a main source of inspiration, vision and hope for all ocean economy role-players.

The five guiding principles, which according to Waage, Banerji, Campbell, Chirwa, Colledner, Dieltiens and Dorward, (2010) are generally associated with sustainable development, were incorporated into the integrated vision for South Africa's ocean economy towards 2060 and included:

a) Principle of holism: need to avoid gaps in a development agenda and the acknowledgement of synergies between the different components.

b) Principle of equity: values, processes and systems generally associated with justice and fairness. For South Africa, dedicated resources must support in building women and youth of the country to receive the necessary skills and work experience to drive the economy forward into the twenty-first century (World Economic Forum, 2017).

c) Principle of sustainability: capacity to persist, and to resist or recover from shocks that affect a system’s productivity. Multiple stakeholders and communities in South Africa partook in exploring and exploiting the ocean economy for commercial and livelihood purposes. Inclusive and collaborated efforts around all six sectors within the ocean economy remained crucial for a sustainable ocean economy towards 2060.

d) Principle of ownership: need for greater ownership of the development process, both nationally and globally.

e) Principle of global obligation: firm commitments to large transfers of resources from developed to developing economies. Global value chains allow for different parts of production processes to be performed anywhere in the world, which drives future-ready training and building resilient economies. As highlighted in the megatrends South Africa needed concerted efforts for it to compete with key major ocean economies and promote training and knowledge in ensuring that the country remained relevant, competitive, and innovative on a global scale.

The central theme of the integrated vision towards 2060 for South Africa’s ocean economy could, therefore, be stated as:

> *Mitigate against future challenges, collaborate and proactively utilise the development opportunities that are offered by the ocean economy*

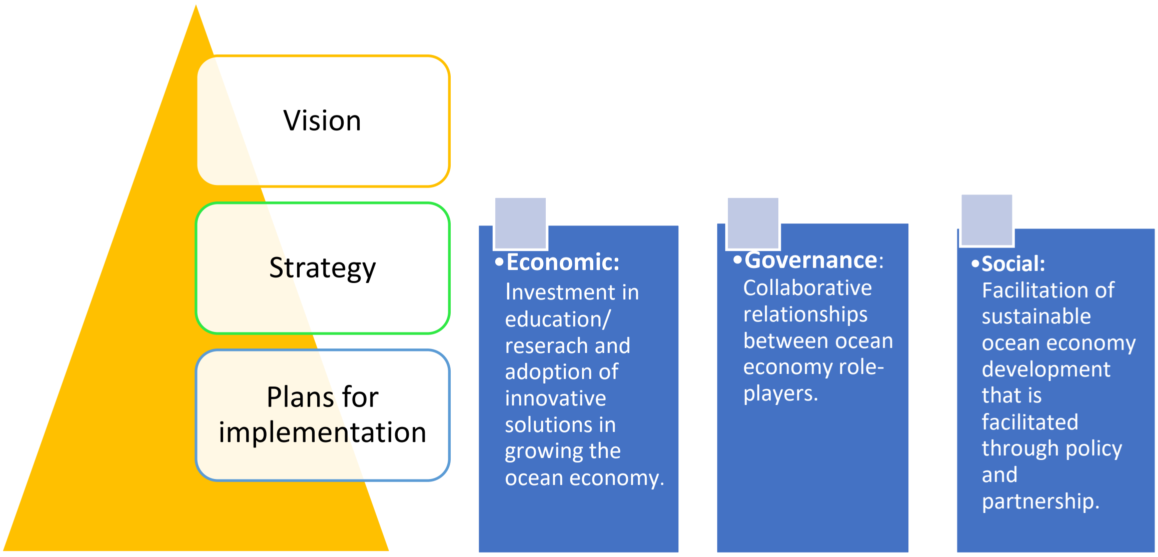
The integrated vision that was proposed for key ocean economy industries was based on the five principles and described as an achievable and preferred future that could become the foundation for a sustainable future for South Africa's ocean economy towards 2060. This vision was essential, for multiple stakeholders across the private, public and non-profit sectors to engage in developing a sustainable ocean economy for South Africa's ocean economy. Chapters 3 and 4 focused on two main issues, namely, ocean economy development and areas that had the ability to promote a sustainable ocean industry that promoted an integrated and a collaborated approach to ocean economy growth. The integrated vision that was proposed for South Africa's ocean economy towards 2060 described an achievable and preferred future that could become the foundation for a sustainable ocean economy. This vision was essential for multiple stakeholders across the private, academia, public, non-profit sectors and community-based organisations to engage in understanding and developing a collective future paradigm for a sustainable ocean economy for South Africa towards 2060. Although there was a growing range of industries in the South African ocean space, the 15 global challenges identified in Chapter 3, unfortunately, affected most of the industries within the South African space. These industries needed to be managed in a coordinated way, to avoid conflicts between marine uses and conflicts with the environment (Department of Environmental Affairs, 2016). South Africa was, therefore, implementing Marine Spatial Planning (MSP) to facilitate integrated management of human uses in the ocean. According to Marine Spatial Planning Bill (Department of Environmental Affairs, 2017), the ocean is one of South Africa's greatest assets and should be well-managed to:

- Balance socio-economic development and ecological sustainability,
- Provide security for public and private sector investment,
- Encourage and attract innovation,
- Increase coordination and integration between sectors to reduce conflicts and enhance synergies,
- Contribute to greater food security.

The proposed integrated vision for the South Africa's ocean economy describes a preferred and achievable future that could become the basis for sustainable ocean economy development in South Africa. The five goals highlighted in the Marine Spatial

Plan are integrated in the vision and take into consideration the three elements highlighted in Section 7.4. As Oberholster (2017) notes, a vision is essential for multiple stakeholders and decision-makers across the private and public sectors to engage in a collective future paradigm for the future of South Africa's ocean economy and that can effectively address the current challenges and limitations. The proposed integrated vision for South Africa's ocean economy towards 2060, is based on the three development pillars as a foundation, which are illustrated in Figure 7.1.

Figure 7.1: Proposed integrated vision for South Africa's ocean economy towards 2060



Source: Adapted from Adendorff (2013) and Oberholster (2017).

As shown in Figure 7.1, a vision is often underpinned by a strategy or strategies with clear plans for implementation. Adendorff (2013) and Oberholster (2017) argue that economic development and macro-economic stability as well as governance and society are fundamental priority areas for South Africa. In ensuring growth and sustainability for South Africa's ocean economy, the Operation Phakisa (Department of Environmental Affairs, 2014) Strategy and the Marine Spatial Planning Bill (Department of Environmental Affairs, 2017) for South Africa were key strategies and policies that promoted an inclusive and a sustainable ocean economy. As a result, the integrated vision for the South Africa's ocean economy towards 2060 placed great emphasis on sustainable development, partnerships and integration.

7.4.1 Economic development

The investment in education / research and adoption of innovative solutions are key for growing and promoting a sustainable ocean economy for South Africa, going into the future and beyond. As highlighted in Chapter 4, under the Operation Phakisa Strategy (2014), the ocean economy also played a major role in South Africa's structural transformation where it was used to create jobs and alleviate poverty. In promoting an integrated vision, it is important to point out that there should be sustainable use, management and conservation of the aquatic and ocean ecosystems as well as associated resources by embracing the principles of equity, low carbon footprint, resource efficiency, social inclusion and broad-based development, with the jobs agenda at the centre of it all.

7.4.2 Governance development

Collaborative relationships between ocean economy role-players would assist in fostering and achieving socio-economic growth for South Africa. Government and the private sector should, therefore, work together for purposes of promoting the ocean and the coastal economic development and growth through the inclusive participation of several key industries and small and medium entrepreneurships to pave ways for small enterprises to participate and thrive. Key to governance and promoting an integrated vision for the ocean economy, holistic ocean protection was key as it would bring together the diverse communities and industries involved in the ocean's protected areas, the coast, ocean management and watershed management as well as promote collaboration in national-level ocean and coastal planning, including the designation of networks of marine protected areas.

7.4.3 Social development

The facilitation of sustainable ocean economy development remained key for South Africa with the challenges of unemployment, inequality and poverty. From a social perspective, the value and benefits of the ocean were numerous as the ocean economy promoted tourism, provided food and nutrition security. In addition, oceans and coasts also aided in the protection of the coast, livelihoods, culture and recreation as well as the ocean. Policy analysis and implementation as well as partnerships were also key for implementing an integrated vision for the ocean economy. From a social perspective, it was also important to remember that ensuring a sustainable ocean economy entailed protection, preservation and conservation of the ocean space so as to protect endangered ecosystems and species. As a result, it was critically important to ensure that adequately skilled and competent people championed all the key priority sectors and partnered with coastal communities in implementing a sustainable vision towards 2060 and beyond.

Neither public nor private institutions in isolation could develop the ocean economy of South Africa on their own. The development of the ocean economy and the implementation of an integrated vision would require a complex interplay of all actors and financially-viable actions. Closer co-operation between the role players in the ocean economy would deepen and fast-track the development of the ocean economy of South Africa. The desired future of an industrialised ocean economy of South Africa was slowly gaining momentum, and increasingly, role players recognised that when truly-exploited and well-managed, the South African ocean economy could constitute a source of wealth and significantly increase South Africa's fortunes and, by doing so, contribute towards the increased economic growth and development of South Africa.

7.5 REVIEW OF EXISTING STRATEGIES IN FACILITATING THE VISION

To provide clarity on the necessary reforms needed to ensure the achievement of the integrated vision, the existing strategies in place at present aimed at promoting a sustainable ocean economy needed to be reviewed. These were highlighted in Chapters 3 and 4, SDG, OECD 2030 ocean economy strategies, AIMS and Operation Phakisa.

These strategies were briefly reviewed in terms of the three development pillars namely:

a) First development pillar reviewed was the economic pillar
b) Second development pillar was governance, which was discussed in the light of regulatory bodies driving an integrated ocean economy development
c) Third development pillar discussed was the social pillar

Adendorff (2013) highlights the need for the South African public and private sector to intensify the application of science, technology and innovation to raise the productivity and efficiency levels across South Africa and to drive widespread social benefits. This cannot be disregarded when a future for South Africa's ocean economy is analysed and proposed.

7.6 AN INTEGRATED VISION FOR SOUTH AFRICA'S OCEAN ECONOMY IN PRACTICE

The integrated vision provided an idyllic state that represented the goals and objectives of stakeholders associated with South Africa's ocean economy was highlighted in Chapter 5 and Chapter 6. The scenario development process required an establishment of a contextually-aligned set of practical guidelines. The communication of the scenarios and their associated practical guidelines were a fundamental part of the study and should be a point of priority for decision-makers and key role-players in the South African ocean economy space. Chapter 6 provided the groundwork for these guidelines. The proposed set of guidelines was intended to provide insight to assist the decision-making processes for key role-players in the South African ocean economy and its six key ocean economy industries as identified in Operation Phakisa (2016).

The set of guidelines were provided per sector, and Figure 7.2 illustrates a diagram, which promotes an integrated approach towards the sector specific solutions, namely:

a) **Marine transport and manufacturing:** The importance of maritime transport in moving goods and commodities around the globe persists. As discussed in Chapters 3 and 4, the transportation of goods by sea remained key considering the challenges that road and air transport modes posed. This would allow for coastal countries to continue to position themselves in terms of facilities and capacities to cater for this growing trade and optimise their benefits from shipping services. This could be achieved by reducing the cost of goods for customers as the transportation cost was reduced as well as port infrastructure and services. The targets set by the International Maritime Organisation (IMO) to reduce GHG emissions from international shipping by at least 50% by 2050 also presented challenges and opportunities for coastal nations. Companies in the sector were required to set decarbonisation objectives for the operations and value chains. Zero-emission vessels and fuels needed to be in operation as early as 2030 to meet the IMO's 2050 ambition and practical guidelines for South Africa was to scale the production of LNG and promote port infrastructure that could supply vessels with LNG. New ship designs, propulsion systems, and alternative fuels that would be integrated into new ships (United Nations, 2020) would also be key for South Africa. It was imperative that research institutions updated their curriculums to meet the standards of the future and promote the skills and entrepreneurs needed to design and build future vessels. The future of transport in the ocean economy would be built on innovation and advanced technologies as had been seen with the emergence of autonomous vessels. This would also present an opportunity for countries to promote innovation, smart population and empower youth and women in future opportunities as identified in the megatrends.

b) **Offshore oil and gas exploration:** As highlighted in Chapter 4, South Africa's economy is mainly supported by its vast mineral resources, however, the country imports about 130 million barrels of crude oil a year on average (Ramulifho, 2014). This meant that there was a high dependence on maritime space, shipping and transportation for the functioning of South Africa's economy not only for goods but for natural resources like oil and gas. Its primary crude oil sources were Iran, Saudi Arabia, Nigeria and Angola (in order of dependency); highlighting the importance of international trade maritime space provide for the country's development (UNCTAD, 2018). The country's refinery could only accommodate 250 million barrels annually (700 000 barrels a day) leading to a consumption of about 24.5 billion fuel litres a year. This needed to be accelerated going into the future as the country's population increased and the demand for transportation, energy and uninterrupted power supply also increased. Gas alone was reported to be critical for the country's economic stability (Plaizier et al, 2013 cited in Ramulifho, 2014). Eskom has its own challenges as power producer in the country and the need for an accelerated Independent Power Producer Procurement Programme (RMIPPPP) issued by South African government, Department of Mineral Resources and Energy has never been so pertinent. There would be an increase in projects and initiatives like Karpowership that would be based within the ocean. Karpowership is basically a power ship that converts gas to electricity using reciprocating engines on-board the vessel, which also need oil and gas to run. Overall, a key recommendation for South Africa is “to create an environment that promotes sustainable exploration while simultaneously maximising the benefits for South Africa” (Karpowership, 2021).

c) **Fisheries and aquaculture:** 50% of South Africa’s fish stocks are of concern, with 22% considered heavily fished and 25% considered heavily depleted (WWF-SA, 2016). Fisheries management approaches and governance were key areas that South Africa needed to strengthen if a sustainable fisheries industry was to be promoted. Aside from over-exploitation of resources, fisheries also had bycatch including dolphins and turtles. The management of bycatch was also a crucial area that was needed as the dwindling ocean stocks were built and replenished. The fishery industry provides more than just a source of protein and food and this has attracted many challenges such as organised crime for the sector (Witbooi et al, 2020). It has also generated many resource-based oceans economic activities, such as mariculture, seafood processing and marine biotechnology (FAO, 2016). As highlighted in Chapter 3, under megatrend 3, global population is expected to reach nine billion by 2050 (World Bank, 2013), and the world food-producing sector must secure food and nutrition for the growing population through increased production and reduced waste. This provides an opportunity for South Africa, which has a vast coastline and a large EEZ to rapidly expand aquaculture production and rapid increases in fish supply.

d) **Marine protection services and ocean governance:** As highlighted by the respondents in the interviews and in Chapters 4 and 5 of the research, it was important to point out that the ocean environment needed to be managed holistically owing to the complex environment and the effect that one activity / industry had on the other. Although South Africa had good policies and strategies that promoted an integrated approach to sustainable ocean economy management, a champion was needed that would collaborate and coordinate the goals identified in the strategies and the various government departments and industries. Oceans and coasts within the Department of Environmental Affairs were trying to promote sustainable ocean economy growth but not at the speed that the challenges of unemployment, pollution, illegal and unreported fishing as well as climate change was presenting to the country. The improper use of natural resources and short-term economic objectives instead of sustainable long-term economic objectives had also resulted in severe environmental degradation, which might reach a level where the health and well-being of the coastal population were threatened, especially in highly-populated urban cities and around estuaries. To achieve the objective of a sustainable ocean economy, there was a need to integrate socio-economic and environmental decision-making with full public support for the protection of the coastal environment. The MSP Act (April 2019) and sector plans that are being developed, for example, 20 marine protected areas (MPAs) gazetted, Oceans & Coastal Information System (OCIMS), vessel tracking, management of harmful algal blooms, water quality programme as well as an integrated and coordinated enforcement programme needed to be communicated, publicised and implemented across all coastal areas in the country.

e) **Small harbours development:** As discussed in Chapter 4, South Africa currently had 12 proclaimed fishing harbours within the Western Cape as well as about 55 unproclaimed harbours along the Northern Cape, Eastern Cape and KwaZulu Natal. No new public harbours had been built since the 1950s (Department of Public Works, 2019). Practical guidelines for the industry would be the proclamation of the 55 unproclaimed harbours as this would allow for proper management and attract funding from various income streams for operations, expansion and operational efficiencies. An analysis of the socio-economic impact (for example, job creation, skills development and enterprise development) and Institutional arrangements (for example, governance and operational management) were key in growing and supporting sustainable small harbour development in South Africa. An acceleration of the harbour infrastructure maintenance, repair and the removal of 29 sunken vessels would also be key as this might have a positive spill over on the marine and tourism aspect within the ocean economy. The development and upgrading to small harbours could promote the building and transformation of infrastructure leading to the sea, for example, roadside trees, shade, coffee shops, traders, bookshops and restaurants lining the cobbled road leading to the water's edge. Several new apartments could be developed and sold or made available for holiday rental. This would have a positive spinoff for coastal towns as the towns could be re-imagined, which would attract investments, create employment, grow economies and promote sustainable development.

f) **Coastal and marine tourism:** As highlighted in Chapter 4, ocean tourism was one of the major contributors to socio-economic growth and development as tourism played an important strategic role in promoting and strengthening international relations. To expand the areas identified in Chapters 4 and 5, a proper investment schemes should be put in place to leverage sustainability of the sector as per the goals set in the NDP 2030 visions. With the challenges experienced by the tourism sector in 2021 because of the COVID-19 pandemic, the significant opportunities that the sector offered for local and international travellers remained relevant and were much needed into the future as countries and economies opened up. Streamlining and implementing electronic visa services for international tourists could increase South Africa's international openness and assist the country with economic growth and reduce the high unemployment rate. Reduction of red tape could strengthen the integration of the tourism sector into local value chains and amplify the impact of tourism on the domestic economy. UNCTAD (2012) also identified that trends in aging populations, rising incomes and relatively low transport costs would make coastal and ocean locations ever more attractive. For tourism to translate into inclusive and sustainable growth, the benefits must spread geographically. However, necessary transport and accommodation infrastructure was needed to connect tourists to places. South Africa's tourism competitiveness could be improved through greater budgetary support for tourism agencies, and measures should be introduced to protect their budgets from the negative impact on currency fluctuation given its impact on marketing in foreign destinations. The establishment of events and routes in six key coastal marine tourism nodes, from uMkhanyakude in KwaZulu-Natal to the West Coast, would benefit tourism as well as the connectivity of the coast to the hinterland.

These practical guidelines for all key ocean economy industries are summarised in Figure 7.2 and, in promoting an integrated approach, it is recommended that the guidelines are never viewed in isolation but in relation to the interrelated and ocean economy space presented in the study.

Figure 7.2: Summary of practical guidelines as per the various ocean economy sectors

Source: Researcher's own construct.

The practical guidelines highlighted in Figure 7.2 would be key for a sustainable ocean economy, which should be factored and presented on key platforms driving South Africa's ocean economy. In addition to the sector specific practical guidelines, cross-cutting practical guidelines made to promote an integrated and a sustainable ocean economy for South Africa towards 2060 include:

- Investment as well as the capacity for innovation and technological evolvement in South African institutions and stakeholders responsible for ocean economy growth remained key.

- In preparing for a competitive ocean economy, South Africa needed to prepare for an upsurge in re- and upskilling in specific areas such as nautical engineering, mechanical engineering, maritime law, analytical thinking and innovation in ocean economy sectors, technology design and programming skills, as well as “human” skills such as creativity, originality and initiative, critical thinking, persuasion and negotiation skills, attention to detail, resilience, flexibility and complex problem-solving.

- Rapidly changing workplace environments required rapidly changing skillsets. Skills-development providers must be scalable in answer hereto and be able to maintain lifelong re- and upskilling as the environment rapidly changed with AI and automation advances in ocean economy industries.

- Collaboration between government, businesses, investors, communities and community-based organisation must be developed to not only become more productive and competitive, but also to ensure humans remained relevant to sustainable ocean economies for many years to come.

7.7 SOURCES OF CHANGE FOR SOUTH AFRICA’S OCEAN ECONOMY TOWARDS 2060

The next pillar in the six-pillar approach to future studies is the timing of the future, which focuses on issues, such as the promotion of a sustainable ocean economy for South Africa through people’s actions and integrated development. A critical question that needs to be asked in this process of foresight creation is, from where does the expected change come? The search for game-changing factors was further guided by the following sources of change, as highlighted by Inayatullah (2013):

- Change which comes from how the world is observed,
- Institutional change or changing the laws that govern society Change, which comes from new technologies, and which changes operations.

Additional guidance was also provided by Bishop, Hines and Collins (2007), who highlighted that change manifests at three levels, namely, the enterprise level (individual, organisation, community), the immediate transactional environment (environment which is dealt with on a regular basis), and the global environment (the world). This categorisation was especially useful to keep the search for local or regional solutions within the global developmental agenda. As a result, the following key sources of change or change areas for a sustainable ocean economy for South Africa towards 2060, linked to the megatrends and drivers discussed in Chapter 5, were identified:

a) Future energy demands and alternative energy sources through sustainable ocean industries should offer the prospect of sustained, environmentally sound, socially inclusive economic growth, as well as foster innovation. Alternative water sources from the ocean, wind, wave and thermal energy changes must promote sustainable ocean economy and build strategies that were important to address SDG14.

b) Changes in population dynamics that promoted a smart population driving ocean economy development and improved social standards. The advances in science and technology were not only crucial for growing the innovation, research and skills within coastal communities but also key in putting the specific maritime nation on the map and improving social standards for local or regional solutions, which promoted integration within the global developmental agenda.

c) With the increasing demand for protein and healthier food, change in food security and improved quality of living through technological breakthroughs would remain key in the promotion of a sustainable ocean economy for South Africa through people’s actions and integrated development. Sustainable fishing practices and fish farming or aquaculture at a larger scale would create empowerment opportunities and result in sufficient supply of fish stocks or resources from the ocean.

d) Increased knowledge and labour productivity across all ocean industries would bring the necessary change around building resilient ocean economies. Improved education levels would assist in growing the ocean economy and promoting resilient economies that could survive after an economic crisis as it happened in 2009 with the global economic crisis and with the COVID-19 pandemic.

e) Antifragile global trade that empowered local communities, youth and woman was key for promoting positive change in the ocean economy space. Global trade and geographical positioning along key transport routes was a key feature for developing countries as it highly correlates with various key sectors and exposes countries and coastal nations to global economic activity. An increased level of involvement of local communities, youth and women in the design and implementation of sustainable ocean economy growth solutions would have an impact on the promotion of a sustainable ocean economy for South Africa through people's actions and integrated development.

f) The economic impact of diseases events (for example, COVID-19) had only showed negative growth for countries, and going forward, South Africa would need to be prepared in disease management and prevention, which would assist in reducing the impact epidemics have on people's health, thus, reducing the economic and social impact of disease events for the ocean economy, which is a global industry.

7.8 SUMMARY

By providing a contextually-aligned set of practical guidelines, Chapter 7 concludes the final steps and stages of the scenario-based planning process and the six pillars of future studies. The results from the environmental scanning, real-time Delphi and the scenarios were useful for promoting dialogue in various platforms on ocean economy development towards 2060. The proposed scenario and vision was aimed at providing leaders in South Africa with insights about how the future might unfold and propose guidelines that would be key in stimulating a sustainable ocean economy, creating enabling governance frameworks, encouraging investments for growth and development, ensuring sustainable use of natural resources, harnessing multidisciplinary research, enhancing safety and security as well as ensuring national, regional and international compliance. The practical guidelines were provided in the context of the three development pillars and the strategic elements discussed in Section 7.3.1. The practical guidelines aid change-agents, policy-makers, decision-makers, academia and influential market participants in driving the South Africa's ocean economy towards the achievement of the integrated vision. Sector specific guidelines should not be analysed and viewed as standalone areas but should take into consideration the complex ocean environment and the integrated approach needed for a sustainable ocean economy for South Africa towards 2060.

Chapter 8 provides the final reflections and conclusion of the research study as well as study limitations and recommendations for future research.

CHAPTER EIGHT

SUMMARY AND CONCLUSION

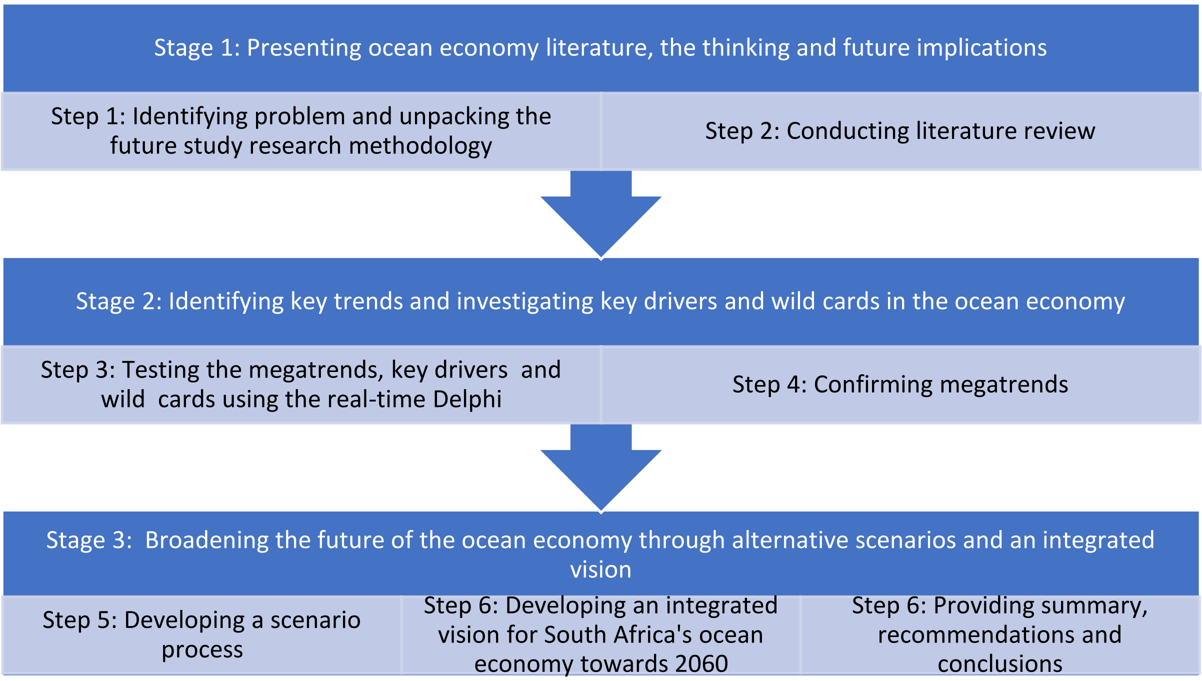
8.1 INTRODUCTION

Chapter 7 explored four scenarios using a scenario matrix for South Africa's ocean economy towards 2060. Chapter 7 further provided key sources of change or change areas for a sustainable ocean economy for South Africa towards 2060, linked to the megatrends and drivers identified earlier in the research. The discussion presented an opportunity to propose suggested actions that the South Africa's ocean economy could use to drive the sector towards a preferred future state (proposed as the integrated vision). Chapter 8 reflects on the research, provides areas of potential strength and weakness, considers future research opportunities and provides final concluding remarks. Finally, Chapter 8 presents a summary of the research guided by the research questions and objectives as outlined in Chapter 1.

8.2 CONCEPTUAL FRAMEWORK OF THE RESEARCH STUDY

As highlighted in Chapter 1, a conceptual framework is an argument about why the topic being studied mattered and outlined the means that were appropriate and rigorous in studying the topic (Collis and Hussey, 2003). As a theory of the future is useful, a conceptual framework that is inclusive of a strong theory and practice for understanding the future is needed. As a result, scenario development was deemed necessary for this research, and the research approach was developed. As highlighted in Chapter 2, the conceptual framework for this research was based on Inayatullah's (2008,2013) six pillars to future studies, which was a good example of a study, which showed a step-by-step approach to scenario development. In analysing future studies methods, scenario development and the research process for unpacking the future of South Africa's ocean economy towards 2060, the conceptual framework was instrumental in guiding the study and forming a foundation for the analysis. From a mixed sequential research method approach that developed explorative scenarios, the researcher concluded that a conceptual framework was necessary, and it guided the study from inception to completion. The conceptual framework was slightly modified from what was presented in Chapter 2. The stages and steps towards the research process were still the same quantity and amendments were only made to step 6. The amended conceptual framework is summarised in Figure 8.1 and shows the quantitative and qualitative elements within the research.

Figure 8.1: Conceptual framework of the research process/study



Source: Researcher’s own construction.

Figure 8.1 illustrates the three-stage process towards developing scenarios and broadening the future of the ocean economy through alternative scenarios and an integrated vision, which were key for understanding the various methodologies that exist for development studies, scenario development and ocean economy development. The frameworks were instrumental in understanding why the topic being studied mattered and outlined means that were appropriate and rigorous in the study.

8.3 SUMMARY OF RESEARCH CHAPTERS

As identified in Chapter 1, the research had eight chapters in total that aimed to respond to the research question and sub-questions to ultimately provide future scenarios for South Africa’s ocean economy towards 2060. Sections 8.3.1 to 8.3.7 provide a brief outline of the contents the study’s chapters. It should be noted that the changes that were incorporated evolved based on what was captured in Chapter 1, specifically expanding on the areas in the literature review and the research process as well as the steps in the Inayatullah’s (2008, 2013) six pillars to future studies. The researcher was able to use secondary literature and primary data for the sequential mixed methods studies and, as a result, was able to respond positively the research questions highlighted in Chapter 1.

8.3.1 Chapter 1 (Introduction and background)

The introduction and background chapter provided a general orientation to the ocean economy, its developmental role and future studies. Chapter 1 also presented the purpose, objectives, the research questions and the futures study methodology that was be applied in the research and its relevance and importance for scenario development. The chapter also highlighted the distinct focus on the ocean economy (using definitions, diagrams and other historical data) and why there is a paradigm shift in terms of sustainable growth and the ocean economy.

8.3.2 Chapter 2 (Research methodology)

The chapter gave an overview on the research design and the methodology of the study selected to address the research problem. Chapter 2 also explained the purpose of scenario development using futures studies, as well as a motivation in favour of the application of mixed research methods in gaining a better understanding of the ocean economy and the developmental opportunities presented by the ocean economy. The sequential mixed method approach as well as the reliability and validity of the study was also explained in Chapter 2. The six pillars of futures studies in terms of their applicability to development studies, scenario development and ocean economy growth was expanded on in the chapter, which was a crucial focus for the research. The relevant techniques related to each pillar were also presented and discussed. Lastly, Chapter 2 gave an overview of the mixed methods research approach in accordance with guidelines as set out by Creswell (2013), Mouton (2001) as well as Leedy and Ormrod (2010).

8.3.3 Chapter 3 (Structure of the global ocean economy towards 2060)

This chapter provided the first literature review and gave an overview of the ocean economy and its development role as well as insight into the sector and developmental challenges that would pose a threat for the sector leading up to 2060. A review of the ocean economy development globally, as well as the key drivers for change and the 15 global challenges key for sustainable development were also provided. The chapter also assessed the ocean economy within a global context in terms of its ability to grow an economy (measured by its contribution to the Gross Domestic Product (GDP)), alleviate poverty and promote greater inclusion within the ocean economy. Finally, the chapter highlighted the key elements of the ocean economy, its development globally and trends as well as the contribution that the ocean economy has made in achieving the sustainable developmental goals aligned with the ocean and inclusive economic growth.

8.3.4 Chapter 4 (Key drivers and wild cards for South Africa's ocean economy)

Chapter 4 presented an inclusive theoretical ocean economy future model for South Africa, which included the use of various future-research methodologies and approaches. A Social, Technological, Economic, Environmental, Political, Legal and Ethical (STEEPLE) analysis on the South African ocean economy provided the basis from which the proposed megatrends for South Africa's ocean economy were identified. Areas discussed in the environmental scan were the challenges of human activities in and around the ocean, mainly their impact on the social, economic and environmental aspects of the ocean economy, the management and governance associated with ocean economy activities and sustainability interventions required to ensure sustainable ocean economy industries for South Africa. The chapter concluded by presenting a future's triangle for South Africa's ocean economy, which highlighted the images of the future for South Africa's ocean economy (pull of the future), the key drivers and trends (push of the present), and the barriers to change in assumptions about the way ocean economy growth and sustainability around key ocean industries (weight of history) were created.

8.3.5 Chapter 5 (Megatrends and drivers for South Africa's ocean economy through the real-time Delphi method)

Chapter 5 presented key elements of the real-time Delphi method, which were employed to check the future importance and probability of occurrences of the identified or proposed megatrends and drivers in the ocean economy. The method was applied to promote the QuanQUAL aspects of the research process and also respond to questions about the future, resource allocations, study designs, effective policies and decision-making key for the ocean economy. A detailed description of the real-time Delphi process as well as the suitability of the method for an ocean economy future study was also presented. The implications of these trends as well as potential game-changing forces, regarding the future of South Africa’s ocean economy were tested with a purposive sample of experts that were knowledgeable and passionate about the future of the ocean economy. Lastly, the chapter presented the outcome of a real-time Delphi study as well as the final trends and driving forces used in the construction of scenarios for South Africa’s ocean economy towards 2060.

8.3.6 Chapter 6 (Proposed scenarios for South Africa’s ocean economy towards 2060)

Chapter 6 provided a scenario matrix for South Africa’s ocean economy towards 2060. Key definitions regarding scenarios and scenario planning as well as the purpose thereof and the value in development planning were also presented. In deepening the scenarios presented in the chapter, the researcher also used a CLA to gain an understanding of the complex and multidimensional areas in ocean economy development and also deepen the future towards a sustainable ocean economy for South Africa. The chapter also provided an argument in support of scenario planning, as a tool to create alternative futures for ocean economy development. A detailed description of the steps and stages in the scenario developmental process for South Africa’s ocean economy towards 2060 were also presented. The four scenarios proposed were:

- Scenario 1: A resilient ocean economy
- Scenario 2: A responsive ocean economy
- Scenario 3: A reluctant ocean economy
- Scenario 4: A recovering ocean economy

8.3.7 Chapter 7 (Integrated vision for South Africa's ocean economy towards 2060)

In this chapter, the future of South Africa's ocean economy was narrowed down to the preferred scenario coupled by an integrated vision for South Africa's ocean economy towards 2060. The chapter commenced with presenting an overview of the preferred scenario towards 2060 and a summary of South Africa's ocean economy taking into consideration capacity and confirmed megatrends as highlighted in the semi-structured interview process.

The preferred scenario was a resilient ocean economy where South Africa, towards 2060, would focus on *improved socio-economic standards and preservation of the natural resources and biodiversity through a coordinated and integrated ocean economy*. As highlighted in the research, South Africa's ocean economy had spanned a number of different sectors, with significant potential synergies providing positive incentives for moving towards better integrated legal, regulatory and institutional frameworks All six key sectors within South Africa's ocean economy needed to leverage their competitive advantage of size and make effective and efficient use of the vast natural resources that the country had as well as make better use of technological innovations to grow its network and customer base to provide solutions through innovative ocean economy industries.

An integrated vision for the ocean economy in South Africa, as well as practical guidelines to address the issue of growth and sustainable development in the ocean economy were the final sections that made up the chapter. The integrated vision for the ocean economy of South Africa is to *mitigate against future challenges, collaborate and proactively utilise the development opportunities that are offered by the ocean economy.*

8.4 ACHIEVEMENT OF RESEARCH OBJECTIVES AND QUESTIONS

This study showed how ensuring a distributed understanding in the analysing of substantial insights into the future involves engaging numerous stakeholders in participatory and interdisciplinary processes by way of complex dynamic systems and processes (Kreibich et al, 2011). Based on the scientific study of possible, desirable and probable future developments, scenarios are formulated on past and continuously changing present conditions (Kreibich et al, 2011). The study further showed that the future for the ocean economy was not entirely determinable but there were various megatrends, wild cards and previous studies that could be used to guide nations towards planning for a sustainable ocean economy.

The primary objective of this research was to develop scenarios for South Africa's ocean economy towards 2060 by considering the six key ocean sectors as outlined in the Operations Phakisa Strategy (2014). This process was guided by Inayatullah's (2008, 2013) six pillars and linked methods towards future studies and scenario development. As a result of the research, a better understanding and best practices of the ocean economy were established as well as how to accelerate the sustainable development of the ocean economy of South Africa. Given the multi-dimensional and complex nature of ocean economic systems and the number of inter-related factors that would influence the success of a sustainable ocean economy for South Africa towards 2060, this research aimed to develop scenarios and a vision for South Africa's ocean economy by achieving the research objectives highlighted in Table 8.1 in Section 8.4.1. Chapter 1 further introduced the main research objective and seven secondary research objectives based on the identified research problem and the primary aim of the study. The seven secondary research objectives are also presented in Table 8.1.

8.4.1 Achievement of research objectives

As highlighted in Chapter 1, the research objectives briefly described what the research was trying to achieve. Table 8.1 provides a link between the seven research objectives as outlined in Chapter 1 and the chapters that aimed to address the research objective. It further showed how the research objectives were addressed in this study.

Table 8.1: Research objectives and areas as to where are they addressed

Research objective	Chapter(s) addressing the objective
RO1: To determine the characteristics of the ocean economy, internationally, regionally and in South Africa by investigating definitions, the status quo and trends	Chapters 1 and 3 *Literature review
RO2: To analyse the developmental role of the ocean economy in South Africa within the context of the global development agenda	Chapters 3 and 4 *Literature review
RO3: To analyse the drivers of change in South Africa and how they influence the growth and sustainability of the ocean economy	Chapter 4 *Literature review and real-time Delphi
RO4: To investigate new and innovative solutions in the ocean economy as alternatives with the highest potential to drive sustained ocean economy growth	Chapter 5 *Literature review and real-time Delphi
RO5: To provide a range of possible scenarios for South Africa's ocean economy towards 2060 and develop a preferred scenario in ensuring a sustainable ocean economy for South Africa towards 2060	Chapter 6 *Semi-structured interviews
RO6: To analyse the key components of the global development agenda and the implication of the various scenarios for South Africa's ocean economy	Chapter 6 *Data analysis and findings from semi-structured interviews
RO7: To investigate the necessary capacity and support needed and which role-players can effectively collaborate in the implementation of a sustainable and integrated vision for South Africa's ocean economy towards 2060	Chapters 6 and 7 *Data analysis and findings from semi-structured interviews

Source: Researcher's own construction.

As shown in Table 8.1, most of the research objectives were mainly addressed in Chapters 3, 4, 5, 6 and 7. Details on how the research objectives were addressed in the various chapters are summarised as follows:

- RO1 on the characteristics of the ocean economy, internationally, regionally and in South Africa by investigating definitions, the status quo and trends was addressed in Chapters 3 and 4, where the researcher provided an overview on what the ocean economy entailed, the 15 global challenges and how they related to the ocean economy and a perspective on BRICS and the African continents on issues and programmes related to the ocean economy.

- RO2 on the developmental role of the ocean economy in South Africa within the context of the global development agenda was also expanded on briefly in Chapter 3 and extensively in Chapter 4. The researcher gave an overview of South Africa's ocean economy, key policies and strategies that drive ocean economy growth and presented an environmental scan on South Africa's ocean economy considering the social, technological, economic, environmental, political, legal and ethical factors of the ocean economy and its key six industries.
- RO3 analysed the drivers of change in South Africa and how they influenced the growth and sustainability of the ocean economy. Seven key drivers for South Africa's ocean economy were identified and discussed in Chapters 4 and 5. Through the real-time Delphi process, the researcher was able to confirm the identified drivers and obtain feedback from the experts on the importance of the drivers in shaping the future of the ocean economy.
- RO4 investigated new and innovative solutions in the ocean economy as alternatives with the highest potential to drive sustained ocean economy growth. In Chapter 4, through the environmental scan, and with the technological drivers, the implications of technology and innovation on the ocean economy were analysed.
- RO5 provided a range of possible scenarios for South Africa's ocean economy towards 2060 and developed a preferred scenario in ensuring a sustainable ocean economy for South Africa towards 2060. An explorative scenario process was followed, which was briefly introduced in Chapter 2 and expanded on in Chapter 6. A four-steps process and a scenario matrix were used to outline the possible futures for South Africa's ocean economy leading to 2060.
- RO6 analysed the key components of the global development agenda and the implications of the various scenarios for South Africa's ocean economy. In addressing the objective, the researcher started by conducting a CLA litany,

worldviews and metaphors for South Africa's ocean economy towards 2060. Using the primary data collected from the experts and key decision-makers in the real-time Delphi as well as the semi-structured interviews, key components from the global agenda around environmental sustainability, social justice, economic growth and innovation were incorporated in the scenarios that presented possible futures for South Africa's ocean economy leading up to 2060.

- RO7 investigated the necessary capacity and support needed and which role-players could effectively collaborate in the implementation of a sustainable and integrated vision for South Africa's ocean economy towards 2060.This research objective was addressed in Chapters 6 and 7, where the researcher used the data from the semi-structured interviews to gauge as to whether South Africa had the necessary capacity and support for a sustainable ocean economy towards 2060. The participants agreed and concluded that South Africa had the capacity, good policies and institutions that could grow and promote a sustainable ocean economy. In promoting collaborative relationships between ocean economy role-players and accelerated efforts aimed at fostering and achieving socio-economic growth for South Africa's ocean economy, a champion, awareness and competitive institutions would need to be key areas for the country. Government and the private sector should, therefore, work together for purposes of promoting the ocean as well as the coastal economic development and growth through the inclusive participation of several key industries as well as and small and medium entrepreneurships to pave ways for small enterprises to participate and thrive.

With the overall aim and objective of this research centred around developing scenarios for South Africa's ocean economy towards 2060, this research allowed for the study analyse the developmental role of the ocean economy sector and identify future challenges and possible disruptions as well as to present scenarios that would proactively utilise the development opportunities that were offered by the ocean economy.

8.4.2 Achievement of research questions

As highlighted in Chapter 1, a research question is a question that a study or research aims to answer. The main research question and seven sub-questions posed for this research addressed a sustainable future for South Africa’s ocean economy towards 2060, which, through analysis and interpretation of data was answered in the study's conclusion. The primary research question for this research was aimed at exploring and providing guidelines on a preferred scenario for South Africa’s ocean economy towards 2060 that considered the six key ocean sectors as outlined in the Operations Phakisa Strategy (Department of Environmental Affairs, 2014). Table 8.2 provides a link between the seven research questions as outlined in Chapter 1 and the chapters that addressed the research questions.

Table 8.2: Research questions and chapters where they were addressed

Research question	Chapter(s) addressing the research question
SQ1: What are the characteristics of the ocean economy, internationally, regionally and in South Africa (considering definitions, the status quo and trends)?	Chapters 1 and 3
SQ2: What is the developmental role of the ocean economy and what implications does the ocean economy have on sustainability and economic growth, internationally and in South Africa?	Chapters 3 and 4
SQ3: What are the drivers of change in South Africa and how do they influence the growth and sustainability of the six sectors within the ocean economy?	Chapter 4
SQ4: What emerging issues need to be taken into consideration in mapping a sustainable ocean economy for South Africa towards 2060?	Chapter 5
SQ5: What range of scenarios can be developed to ensure a sustainable and a preferred ocean economy for South Africa towards 2060?	Chapter 6
SQ6: What are the key components of the global development agenda and how does each scenario link to the global agenda and South Africa’s ocean economy?	Chapter 6
SQ7: Do the necessary capacities and support exist in the country, and which role-players can effectively collaborate in the implementation a sustainable and integrated vision for South Africa’s ocean economy towards 2060?	Chapters 6 and 7

Source: Researcher’s own construction.

As shown in Table 8.2, most of the research questions were mainly addressed in Chapters 3, 4, 5, 6 and 7. A summary of the research questions listed in Table 8.2 that were addressed in the research includes:

- SQ1 on the characteristics of the ocean economy, internationally, regionally and in South Africa was responded on through a literature review that investigated definitions, the status quo and trends on the ocean economy as highlighted in Chapters 3 and 4, where the researcher gave an overview on what the ocean economy entailed. The key findings as highlighted in section 3.2 and section 3.3 is that the ocean economy has an important role in development in general and in promoting sustainability. The ocean economy connects nations through sea transportation, provides renewable energy options through wave and tidal energy and also provides for food security through fisheries.

- SQ2 on the developmental role of the ocean economy in South Africa within the context of the global development agenda was responded to and expanded on briefly in Chapter 3 and extensively in Chapter 4. From the research it was evident that South Africa's ocean economy had a key developmental role to play not only for environmental or ecological sustainability but also in addressing the future energy demands for the country, food security and promoting improved social standards. With South Africa adopting the Operation Phakisa Strategy (Department of Environmental Affairs, 2014) for growing the ocean economy, it responded to the notion of promoting economic growth, job opportunities and growing a sustainable ocean economy that would put South Africa on the map in terms of continental and international trade.

- SQ3 explored what the drivers of change in South Africa were and how they influenced the growth and sustainability of the six sectors within the ocean economy. This question was responded to in Chapter 4 through a STEEPLE environmental analysis for South Africa's ocean economy and through a literature review that considered what the key six ocean economy sectors represented and what challenges or trends could negatively affect a sustainable ocean economy for South Africa going into the future. A futures triangle was also developed considering the pull and the push for South Africa's ocean economy leading to 2060.

- SQ4 responded to emerging issues that needed to be taken into consideration in mapping a sustainable ocean economy for South Africa towards 2060. Chapter 5 used the analysis from the literature presented in Chapters 3 and 4 and identified six megatrends, key drivers and wild cards that had disrupted the ocean economy. This was aimed at analysing emerging issues that needed to be taken into consideration, and evident from the research, there were key areas (namely, climate change, pollution, inequality and technology) for a sustainable ocean economy for South Africa towards 2060.

- SQ5 responded to the question of possible scenarios that could be developed in ensuring a sustainable and preferred ocean economy for South Africa towards 2060 and the scenarios were presented in Chapter 6. A scenario matrix was developed, and four scenarios were identified. These scenarios were tested through a qualitative research approach. and from the semi-structured interviews, it was evident that the preferred and possible scenarios for a sustainable ocean economy for South Africa towards 2060 was a resilient ocean economy. The scenario was characterised by a dominant focus on improved socio-economic standards and preservation of the natural resources and biodiversity through a coordinated and integrated ocean economy.

- SQ6 responded to the question of key components of the global development agenda and how each scenario linked to the global agenda and South Africa's ocean economy. As highlighted in Chapters 3 and 4, the SDGs and the targets set for South Africa's ocean economy were key measures that were used to assess as to how the country had done in responding the global agenda of sustainability and inclusive growth. The integrated vision for the ocean economy of South Africa was proposed in Chapter 7 was key in summarising the key components of the scenarios and proactively identifying the development opportunities that were offered by the ocean economy and its various six sectors.

- SQ7 responded to the capacities and support central in the implementation, for a sustainable and integrated vision for South Africa's ocean economy towards 2060. From the research, highlighted in Chapters 6 and 7, it was evident that South Africa had the capacity from a natural and human resource perspective as well as policies and strategies aimed at growing a sustainable ocean economy towards 2060. Areas that the country needed to focus on were having a champion that would drive the initiatives across all the six key industries as captured in the Operation Phakisa Strategy (Department of Environmental Affairs, 2014). Initiatives to accelerate technological innovations, awareness, partnerships as well as address the challenges of pollution, climate change, illegal and unethical behaviour in all key ocean economy sectors were also vital.

In exploring and providing guidelines on a preferred scenario for South Africa's ocean economy towards 2060 that considered the six key ocean sectors as outlined in the Operations Phakisa Strategy (Department of Environmental Affairs, 2014) the mixed method approach followed in the research was sufficient in responding to the main research question. It is evident in the research that a thorough literature review looking at the global development agenda, global challenges and the role of the ocean economy serves as a good basis for the quantitative data collection instrument used in the form of the real-time Delphi and also the qualitative structured interviews.

8.5 FINDINGS AND RECOMMENDATIONS BASED ON RESULTS

For ensuring a sustainable ocean economy, it was key that all plans and decisions on the ocean economy and the various industries supported sustainability criteria. In assessing the 17 SDGs in Chapters 3 and 4, it was evident that all public private partnerships must have explicit goals to deliver sustainable development and promote an integrated approach across all ocean economy sectors.

Higher level integration among ocean economy role-players and economic opportunities that promoted inclusiveness and sustainability would act as a main source of inspiration, vision and hope for South Africa's ocean economy towards 2060. The key to success is the effort of multiple stakeholders, research and data that are underpinned by the unique challenges and resources that South Africa's ocean environment presents. In addition, the adoption of technologies that boost high levels of productivity, process and business or system innovations in the key six ocean industries highlighted in the research are vital.

In line with The Dinokeng's (2009) *Walk together* scenario, a state is needed which is characterised as becoming increasingly catalytic and collaborative, enabling by listening to its citizens and leaders from different sectors, engaging with critical voices as well as consulting and sharing authority in the interest of long-term sustainability. The identified future for South Africa's ocean economy must promote an environment where all role-players, communities, the young and old can walk together. The Indlulamithi's (2019) positive scenario of in a precise sequence of steps, the *Nayile walk* choreographs a vision of South Africa where growing social cohesion, economic expansion and a renewed sense of constitutionalism to get South Africa going are practiced. This further confirms a desired future for South Africa's ocean economy in line with a positive direction for the country.

The four scenarios for South Africa's ocean economy were developed to illustrate how conditions for ocean economy development and the key six sectors could unfold and change for South Africa towards 2060. Various scenarios for South Africa's ocean economy, which incorporated different economic, demographic, environmental and socio-economic futures were a key focus of the research and Chapters 6 and 7 were key in discussing the scenarios and proposing an integrated vision. The integrated vision to promote a sustainable ocean economy for South Africa towards 2060 identified was *to mitigate against future challenges, collaborate and proactively utilise the development opportunities that are offered by the ocean economy.*

The identified wild cards discussed in Chapters 4 and 5 also provide indicators for possible future challenges include:

- Environmental disasters such as oil spill and dumping at sea
- Migration patterns of global citizens
- Widening gap between rich and poor
- Corruption and theft in the ocean economy
- Future pandemics

The research study, therefore, requires complete engagement and adoption from the private sector and public sector in order to drive the necessary change navigation towards a preferred future state. Currently, the South African private and public sectors are fragmented and divided – meaning that additional effort is needed to ensure prosperous partnerships are created. In the recommendations, the implications for the respective sectors and the future challenges should at all times be considered.

8.5.1 Recommendations for scenario 1: A resilient ocean economy

The identified scenario for South Africa's ocean economy is about a collective and purposeful effort by all role-players to acknowledge and promote inclusive and sustainable growth for the key six ocean economy sectors. This was confirmed in Chapter 6, where the preferred scenario for South Africa's ocean economy was scenario 1. The scenario signifies a resilient ocean economy for South Africa characterised by a dominant focus on improved socio-economic standards and preservation of the natural resources and biodiversity through a coordinated and integrated ocean economy. The first scenario is one in which the three main elements of socio-economic growth and sustainability (environmental, social and economic) are successfully addressed. This is achieved through advances in research and data on the ocean economy, digital technologies that are increasingly being used to drive and facilitate innovations in all six key ocean economy industries and capable institutions that have an integrated approach towards ocean economy development. In the event that this scenario materialises, then it is recommended that:

- Marine transport and manufacturing industry invest in research and skills that will support efficient ports and advanced technologies for vessels and ships. The advances and concerted efforts on marine transport and manufacturing can lead to improved socio-economic standards through increased knowledge and job opportunities. With shipping identified as key for global trade and transportation, this scenario will also promote sustainable shipping that considers low emissions, reduced or zero pollution from ships and preservation of the natural environment and biodiversity.

- The offshore oil and gas exploration industry will promote improved socio-economic standards and sustainable use of natural resources. This will be possible through training on innovative technologies that can extract oil and gas without disturbing or destroying the seabed and the ecosystems within South Africa’s oceans. Other positive outcomes that can be realised through the integrative concept of resilience is the promotion of policies and initiatives that promote alternative and re-usable energy. This will also alleviate the pressure to solely rely on oil and gas for key industries and for energy provision within households.

- The fisheries and aquaculture industry will promote resilience through increase awareness and a better understanding of the fish resources, their status in terms of being under-developed, over-developed and sustainability levels. In promoting a resilient fisheries and aquaculture sector, increased efforts for innovative aquaculture initiative, both freshwater and ocean-based aquaculture, will be key in growing the protein base that future populations will require and also addressing the challenges of food security.

- The small harbour development sector will promote resilience through concerted efforts on training, research and education. As highlighted in Chapter 5, South Africa has the ability to build world class boats and infrastructure to support small harbours and their local areas. Innovation and knowledge will promote empowered local communities, youth and women and also accelerate economic growth in the towns where the small harbour development will take place.

- Marine and coastal tourism will promote resilience through innovative tourism initiatives characterised by socio-ecological growth benefits, which support employment and equality, especially the promotion and empowerment of local communities, women and youth in coastal tourism initiatives as well as sustained economic growth as this sector is less capital intensive compared to the other sectors.

- Marine protection services and governance will be key in ensuring that the policies and legislation developed to promote equitable access and sustainable growth across all ocean economy sectors are implemented. The implementation of key policies such as the Marine Spatial Bill, the Integrated Coastal Management Act, Natural Environmental Management Act and Operation Phakisa will be key in promoting resilience and an ocean economy industry that is characterised by reduced challenges and innovations that promote a sustainable future for South Africa's ocean economy.

8.5.2 Recommendations for scenario 2: A responsive ocean economy

The identified scenario for South Africa's ocean economy was a responsive ocean economy where socio-ecological resilience is poorly-embedded and innovations within ocean economy industries is highly-embedded. The scenario represents an ocean economy future for South Africa that is highly characterised by a dominant focus on innovation to respond and catch up with global norms and trends at the expense of socio-economic standards that promote equality, inclusivity and sustainability. All key ocean economy sectors will be quick to want to adopt and implement global trends and innovations that promote growth even if a balance is not maintained around inclusivity and sustainable use of natural resources within ocean economy industries. A responsive economy is not ideal for South Africa and the recommendations proposed are not at promoting a responsive ocean economy but should be used as warning signals and possible threats that might affect the sustainability and economic growth needed by South Africa from this key industry. The recommendations for this scenario include:

- Marine transport and manufacturing industry will need to invest in research and skills that have a dominant focus on innovation with little regard for labour productivity and efficient ports needed for a competitive marine transport sector for South Africa. Advanced technologies for vessels and ships (for example, autonomous vessels) will be implemented but little emphasis will be placed on ecosystem functionality and the negative impact that noise from vessels or collisions with ocean mammals that could possibly occur with the automated vessels.

- Offshore oil and gas exploration industry will promote innovation to respond and catch up with global norms, especially around energy provision for LNG and oil needed in supporting growing population trends and a rise in middle classes. Challenges and negative implications from innovative initiatives that disregard socio-ecological resilience are those that will not penalise and reduce pollution from oil and gas, with little focus placed on empowering local communities and women, the destabilisation of the marine environment through intensive dredging and feasibility exploration exercises trying to find oil and gas reserves in the ocean.

- Fisheries and aquaculture industry is a key employment and growth sector for the Western Cape as well as key coastal communities in that province and in South Africa. A responsive fisheries and aquaculture sector will be quick to want to adopt and implement global trends and innovations that promote growth even if a balance is not maintained around inclusivity and sustainable use of natural resources within ocean economy industries, especially for local communities and women that are largely dependent on fisheries for their livelihoods. In promoting a sustainable ocean economy, it is recommended that global trends and innovations in the fisheries and aquaculture industry to pay attention to the employment prospects offered by the industry and promote growth that ensure inclusivity and sustainable use of natural resources.

- Small harbour development is a key area for South Africa to promote innovative programmes and initiatives that respond to and catch up with global norms and trends but not at the expense of socio-economic standards that promote inequality, social and economic exclusion as well as unethical business approaches. The innovations at a small harbour development scale could present key grounds for learning and growing the skills needed for a competitive and a growing industry for local economies, especially for those that have been low in terms of economic growth. The other opportunity for innovation that could positively affect other key sectors such as fishing include locally built boats locally and slipways for fisherman and tourism operators to launch their small boats.

- Marine and coastal tourism in South Africa is highly characterised by local communities and businesses showcasing the unique natural features and experiences that the coastal environment presents. A dominant focus on innovation to respond to and catch up with global norms and trends at the expense of socio-economic standards that promote equality, inclusivity and sustainability might be dangerous for the rich cultural heritage that South Africa has and preserving this for generations to come. On the one hand, innovations aimed at safe diving, snorkelling and cruise industry might be beneficial for the country if marketed properly and if inclusive of local communities, women and youth.

- Marine protection services and governance is key in promoting ethical institutions, communities and regions that ascribe to the SDGs and laws and policies developed around the ocean economy. Dominant focus on innovation to respond to and catch up with global norms and trends at the expense of socio-economic standards that promote equality, inclusivity and sustainability will have to be eliminated through the policies, legislation and awareness driven by government and various stakeholders in promoting sustainable ocean economies.

8.5.3 Recommendations for scenario 3: A reluctant ocean economy

The identified scenario for South Africa's ocean economy was a reluctant ocean economy for South Africa characterised by a dominant focus on inequality and poor socio-economic standards. The scenarios suggest that innovations on ocean economy industries will not be informed by research and development unique to South African conditions and the technologies will be expensive and inaccessible for majority of the coastal communities and role-players that are key in promoting a sustainable, ethical and an inclusive ocean economy for South Africa towards 2060. The recommendations proposed are not at promoting a reluctant ocean economy but should be used as warning signals and possible threats that might affect the sustainability and economic growth needed by South Africa from this key industry, namely:

- Marine transport and manufacturing industry is the backbone of trade for South Africa. In the absence of research and skills that will support efficient ports and advanced technologies for vessels and ships, this might impact negatively on the attractiveness of South African ports and also on the labour skills, knowledge and productivity in the industry. A scenario that represents a marine transport and manufacturing industry that is reluctant where technologies will be expensive and inaccessible for majority of the coastal communities and role-players will slow the growth of the country and its global ranking in terms of trade and sustainable growth.

- Offshore oil and gas exploration industry scenario that is reluctant will promote a high reliance for South Africa on the major oil producing countries in the world. This will pose challenges for those households that have low incomes when the price of oil and gas rise. If technologies are expensive and inaccessible for coastal communities, this will be a challenge for role-players who are key in promoting and growing businesses as well as promoting a sustainable, ethical and an inclusive ocean economy for South Africa towards 2060.

- Fisheries and aquaculture industry are key for food security, livelihoods for coastal communities and subsistence fisheries. If technologies are expensive and inaccessible for coastal communities and role-players who are key in promoting a sustainable, ethical and an inclusive fisheries industries, communities and families will struggle with safe and efficient fishing technologies and accessing markets for growth prospects will remain a continuous challenge.

- Small harbour development is key for aspiring toward smart population and promoting growth and training for local communities, women and the youth. If technologies are expensive and inaccessible to promote small harbour development, the competitive skills and research needed for a sustainable small harbour sector and local economic growth needed by South Africa from this key industry will become a challenge to achieve.

- Marine and coastal tourism is identified as one of the key growth sectors that can create the targeted number of jobs and opportunities for local economies, women and youth in South Africa. A reluctant ocean economy for South Africa characterised by a dominant focus on inequality and poor socio-economic standards will also affect the attractiveness of the country based on how the world views the country and tourists might not feel safe when visiting the country.

- Marine protection and governance will be key in promoting the achievement of the 17 SDGs and laws and policies developed around the ocean economy. In the absence of socio-ecological resilience and innovations within South Africa's ocean economy, the country can forget in competing globally on issues of sustainable development. It will also be a problem for the country to attract investment, create partnerships and promote knowledge exchanges as well as best practices aimed at growing a sustainable ocean economy towards 2060.

8.5.4 Recommendations for scenario 4: A recovering ocean economy

The identified scenario for South Africa's ocean economy was a recovering ocean economy for South Africa characterised by a dominant focus on socio-economic standards that promote equality, inclusivity and sustainable use of natural resources within ocean economy industries but lacking in terms of innovation and promoting smart populations. Innovation and technologies that can compete on a global scale will not be developed, lack of research and development and investments on innovations within all ocean industries will not allow for the country to fully explore its vast coastline and generate the necessary economic growth attributed to a sustainable ocean industry. Recommendations for scenario 4 include:

- Marine transport and manufacturing industry will not invest in research and skills and will not promote innovations that support efficient and competitive ports as well as advanced technologies for vessels and ships. With shipping identified as key for global trade and transportation, a recovering ocean economy that is not globally relevant will not promote sustainable shipping that considers low emissions, reduced or zero pollution from ships and preservation of the natural environment and biodiversity if a balance is not maintained between socio-ecological resilience and innovations within ocean economy industries.

- Offshore oil and gas exploration industry that is recovering will promote a dominant focus on socio-economic standards that promote equality, inclusivity and sustainable use of natural resources within ocean economy industries with very little focus on innovation and technologies. This might pose challenges, even if South Africa has improved socio-economic standards and sustainable use of natural resources, if it cannot accelerate drilling and exploration initiatives that will make it globally competitive. The country will also then have to import the resources and charge the end-user higher prices. This will also not assist in terms of government alleviating the pressure to solely rely on oil and gas for key industries and for energy provision within households as they will be focusing solely on job creation and not on other clean alternative energy options.

- Fisheries and aquaculture industry characterised by a dominant focus on socio-economic standards that promote equality, inclusivity and sustainable use of natural resources within ocean economy industries but lacking in terms of innovation and promoting smart populations will never sustain the ocean economy or allow for the country to recover from the challenges it faces. A recovering fisheries and aquaculture sector that embeds socio-ecological resilience will be key in growing the healthy nations and promoting food security. In the absence of increased efforts for innovative aquaculture initiatives, both for freshwater and ocean-based aquaculture, this will impede on increasing fish stocks and creating jobs for local communities, youth and women.

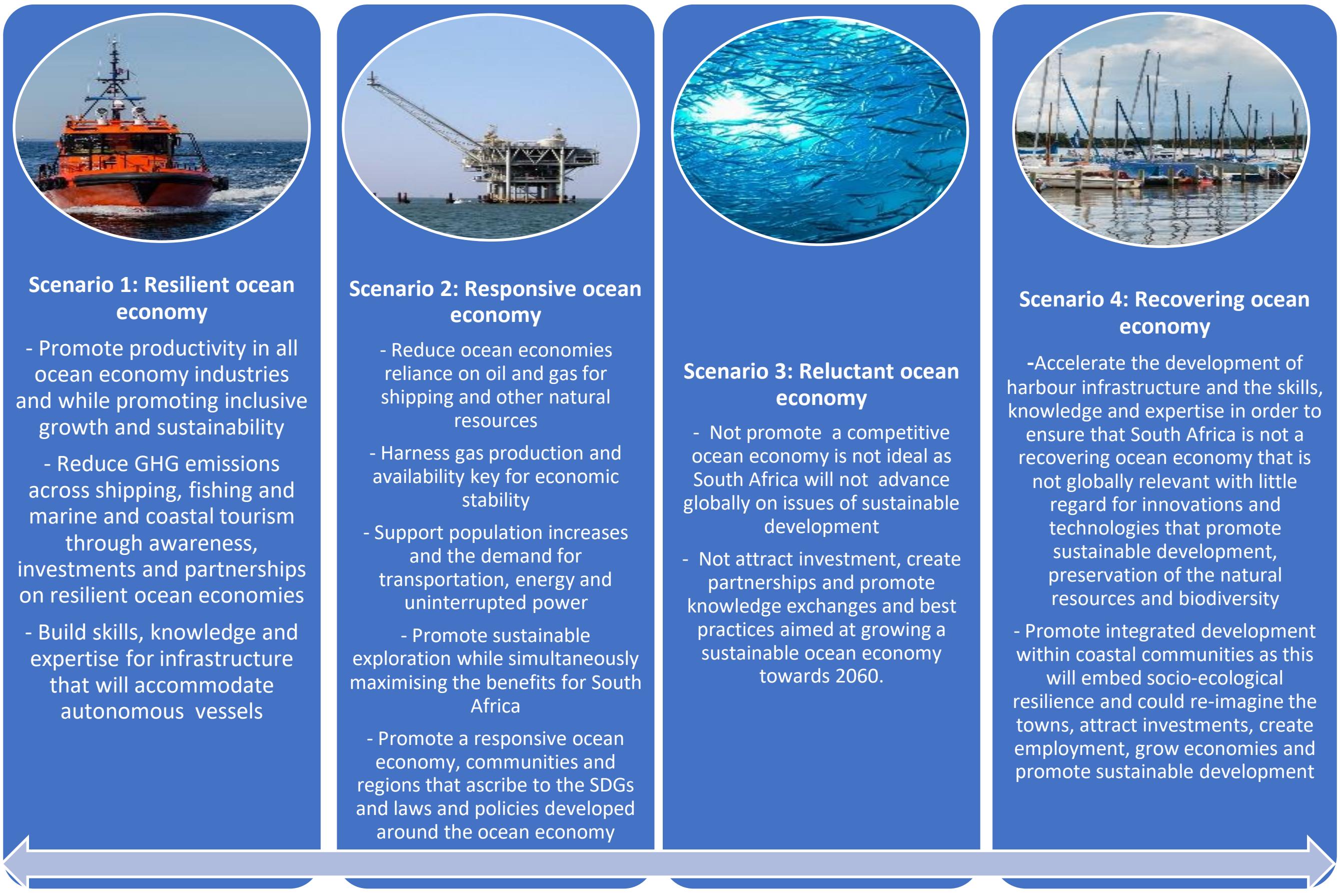
- Small harbour development sector is characterised by a dominant focus on socio-economic standards that promote equality, inclusivity and sustainable use of natural resources within ocean economy industries but lacking in terms of innovation and promoting smart populations. Innovation and knowledge in small harbour development is something that will promote empowered local communities, youth and women and accelerate economic growth in the towns where the small harbour development will take place.

- A recovering marine and coastal tourism with a dominant focus on socio-economic standards that promote equality, inclusivity and sustainable use of natural resources within ocean economy industries, but lacking in terms of innovation, will be a danger for sustainable jobs and growth. The notion of attracting investors and tourists across the globe and promoting smart populations local communities, women and youth in coastal tourism initiative and sustained economic will remain a challenge for South Africa and its ocean economy towards 2060.

- Marine protection services and governance will be key in ensuring that the policies and legislation developed to promote equitable access and sustainable growth across all ocean economy sectors are implemented. In ensuring that South Africa does not have a responsive ocean economy, innovations and technologies that promote knowledge creation or research and smart populations would not be promoted as well as institutions and platforms like the BRICS to promote partnership and investment in all key six sectors. In addition, integrated development within coastal communities will be promoted as this will embed socio-ecological resilience and could re-imagine the towns, attract investments, create employment, grow economies and promote sustainable development.

The recommendations for all ocean economy sectors as per the proposed scenarios are summarised in Figure 8.2. To promote an integrated approach, it is recommended that the guidelines are never viewed in isolation but in relation to the interrelated and ocean economy space presented in the study.

Figure 8.2: Summary of recommendations for all ocean economy sectors as per the proposed scenarios



Source: Researchers' own construct

The recommendations highlighted in Figure 8.2 are a call for action or a need for solutions to the challenges raised in the research for South Africa's ocean economy and the key six ocean sectors. In promoting a sustainable future for South Africa's ocean economy, the cross- cutting practical guidelines made in Chapter 7 and the proposed integrated vision for all sectors should be shared and discussed with all role-players in ensuring that towards 2060, a sustainable ocean economy for South Africa towards is fully-explored and implemented.

Towards 2060, a sustainable future for South Africa's ocean economy that promotes integration and collaboration will need role-players who become increasingly catalytic and collaborative, enable and listen to its citizens and leaders from different sectors, engage with critical voices, consult and share authority in the interests of long-term sustainability.

8.6 CONTRIBUTION OF THE STUDY

When considering the purpose of this study, several contributions are evident, ranging from the theoretical value, methodological contribution of the study, to the policy implications and decision-making contribution for a sustainable ocean economy for South Africa towards 2060. These contributions include:

a) **Theoretical value:** An exhaustive review of a variety of literature sources on the ocean economy, the developmental role of this sector and phases included in futures studies processes, scenario-based planning was the key focus area in the research and Chapters 2, 3 and 4 expanded on the various literature sources. The aim of reviewing the literature was to gain a better understanding of the topic and integrate the independent research disciplines around ocean economy (namely, environmental challenges and climate change, coastal and marine tourism as well as the use of future studies to broaden the future of the ocean economy through offering alternatives). With challenges presented by the COVID-19 pandemic, little research was published, and the study relied heavily on publications by government departments, media publications and webinars presented. The knowledge and information received from the various platforms and sources assisted with the theoretical value realised in the research.

b) **Policy implications:** The shaping of regulatory and policy frameworks on the ocean economy within the contexts of specific national and regional realities is key for a sustainable future. Scenarios can be seen either as *products* that may be the basis of decision-making or as learning processes, and from a policy implication, the development of scenarios within this study was certainly a learning process. The contribution that the study aims to make could assist policy developers and decision-makers or key role players in the South African ocean economy to better understand and use ocean economic growth as a key enabler to expand economic opportunities in South Africa. The key benefits that will support the global-development agenda and attainment of the SDGs with specific focus on SDG 14 include:

- Creation of inclusive and sustainable ocean economy developments, in various economic activities and sectors (namely promote the inclusion of woman and youth in fishing and aquaculture, promote smarter populations that will drive ocean economy development and resilient ocean economies that are underpinned by competent and well-capacitated organisations, companies and populations). An essential condition for a South African maritime institutional and regulatory environment is the promotion of sustainable management of the South Africa aquatic resources and environment to ensure biodiversity and ecosystem resilience.
- Building/enhancing of institutional capacity by way of a multi-stakeholder approach involving various stakeholders and partnerships in developing sustainable ocean economies.

c) **Methodological contribution:** In expanding on future studies and mixed methods research, this research investigated an interdisciplinary study of the ocean economy by considering the key six ocean economy sectors in South Africa and applied a futures study approach in developing scenarios and an integrated vision for South Africa's ocean economy towards 2060. Several studies have attempted to respond to the question as to whether future studies are a qualitative or a quantitative research approach, the experience with the research was a combination of both qualitative and quantitative approaches. The overall goal of mixed methods research, of combining qualitative and quantitative research components was to expand and strengthen the study's conclusions and, therefore, contribute to the published literature of non-mixed methods research around the ocean economy for South Africa. In all studies, the use of mixed methods should contribute to answering the research questions.

It should be noted that the contributions of the study, however, need to be contextualised along with various limitations as discussed in Section 8.7.

8.7 STUDY LIMITATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

The research acknowledges the high level of complexity related to ocean economy development and equitable access and rights to natural resources that lie at the heart of the economic, social, environmental and political challenges sustainable economic growth in South Africa. Limitations cited by the researcher are influences or factors that the researcher could not control.

8.7.1 Limitations to the study

With the ocean economy viewed as an emerging economy for South Africa, other limitations that hindered the study was access to secondary data especially around the coastal and marine tourism sector and oil and gas. The limitations to the study are further expanded in the summarised section below:

- **Literature and recent information on all six sectors in the ocean economy:** The shortcomings came from limited information in addressing or attempting to find responses pertaining to the 15 global challenges and the ocean economy. Data and literature in 2020 were limited due to the COVID-19 lockdown, which impacted many countries around the world and, to some extent, many ocean economy industries (for example, coastal and marine tourism as well as oil and gas activities)

- **Data collection tool:** It is widely-accepted that researchers must make known the shortcomings and challenges experienced in their data collection. With the real-time Delphi, the limited understanding of the platform and the recruitment process hampered the researcher to be better prepared and expand on the sample. Real-time Delphi is also a platform that is not mainly understood and used in South Africa and in the Ocean economy, and limitations that were experienced were mainly the reluctance from participants, especially with the limited understanding of the various browsers that real-time Delphi supports.

- **Limited availability of global experts on all ocean economy industries:** With the interdisciplinary and intradisciplinary nature of ocean economy emerging, the availability of experts that were well-versed in all industries was a limitation. There are, however, experts who have advanced skills, knowledge and experience across various geographic regions on ocean economy development, but their interest and availability to participate in research was limited. Other influences that could not be controlled by the researcher were participants timeously taking part in the research, which placed restrictions on the desired methodology and conclusions.

8.7.2 Recommendations for future research

The South African government responded to ocean economy development and growth under the Operation Phakisa with the government identifying South Africa's ports and harbours, aquaculture sector, coastal and marine tourism, small harbour development as well as marine protection services and governance as important components of its ocean economy strategy. In contemplating the implementation of an integrated vision and a sustainable ocean economy for South Africa towards 2060, the following recommendations for future research were identified:

a) Use of mixed methods research that are predominantly quantitative would be key in providing an updated study on the value of South Africa's ocean economy and the natural capital required to promote sustainability towards 2060.
b) Exploration of mixed research methods that could promote an action-oriented scenario process for complex environments like the ocean economy.
c) Smart population features, and approaches required for a sustainable ocean economy towards 2060 characterised by high levels of productivity and skills.
d) Partnerships and an integrated approach would be key for a sustainable ocean economy. Future research should explore public private partnerships and institutions that would promote the development of a sustainable ocean economy that addresses the targets identified for SDG 14 life below water.
e) South African financial sector would be a key partner in bringing about the shift to sustainable development of all key ocean economy sectors in South Africa. Despite the financial sector's importance, lack of access to finance and crowd funding initiatives for key ocean economy development initiatives remain a challenge, and future research should be conducted on promoting access to finance for sustainable ocean economies.

f) Regional strategies based on BRICS and SADC with clear goals and plans should be developed in promoting a sustainable ocean economy on multinational level.
g) An analysis as to how South Africa can enhance the creation of both qualitative and quantitative data to identify the policies that would maximise sustainable jobs and sustainable growth in the ocean economy and all its key six sectors.

8.8 SUMMARY AND CONCLUSION

The objective of this study was to demonstrate the importance of ocean economy and development studies and the success of a sustainable ocean economy for South Africa towards 2060. The research began with an identification of a research problem and a possible contribution that the research could make regarding future studies and ocean economy development. The research commenced with a preliminary literature review, a clear outline of the research approach and methods as well as a comprehensive literature review on global ocean economy development and on South Africa as a country. The research then expanded with a comprehensive environmental scan, from which various trends and driving forces emerged. A real-time Delphi study was also conducted to validate and prioritise the megatrends and driving forces that emerged from the research. Subsequently, the research effort presented four future scenarios that aimed to provide a better understanding of the future for South Africa's ocean economy over the next 40 years. The scenarios were developed by following a predetermined process, which was directed by the Six Pillars of Futures Studies (Inayatullah, 2008; 2013) and the technique of scenario writing, as proposed by Schwartz (2007). The four scenarios developed for South Africa's ocean economy aim to stimulate new thoughts on a broader developmental approach to ocean economy development and to identify gaps in the knowledge about a broad range of research issues relating to the level of complexity with regard to planning and the decision-making environment. An integrated vision was developed for South Africa's ocean economy towards 2060. The development of the integrated vision statement was also a key area for the research as it helped to increase the comprehensiveness and inclusiveness from various sectors and different stakeholder groups in ocean economy development.

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APPENDIX 1: ETHICS APPROVAL LETTER

NELSON MANDELA
UNIVERSITY

PO Box 77000, Nelson Mandela University, Port Elizabeth, 6031, South Africa mandela.ac.za

Chairperson: Research Ethics Committee (Human)
Tel: +27 (0)41 504 2347
sharlene.govender@mandela.ac.za

NHREC registration nr: REC-042508-025

Ref: [H20-BES-DEV-043] / Approval]

2 September 2020

Prof C Adendorff
Faculty: BES

Dear Prof Adendorff

SCENARIOS FOR SOUTH AFRICA'S OCEAN ECONOMY TOWARDS 2060

PRP: ~~Prof C Adendorff~~ Dr Amanda van den Berg
PI: Ms N Hadi

Your above-entitled application served at the Research Ethics Committee (Human) (*24 June 2020*) for approval. The study is classified as a medium risk study. The ethics clearance reference number is **H20-BES-DEV-043** and approval is subject to the following conditions:

1. The immediate completion and return of the attached acknowledgement to Imtiaz.Khan@mandela.ac.za, the date of receipt of such returned acknowledgement determining the final date of approval for the study where after data collection may commence.
2. Approval for data collection is for 1 calendar year from date of receipt of above mentioned acknowledgement.
3. The submission of an annual progress report by the PRP on the data collection activities of the study (form RECH-004 available on Research Ethics Committee (Human) portal) by 15 November this year for studies approved/extended in the period October of the previous year up to and including September of this year, or 15 November next year for studies approved/extended after September this year.
4. In the event of a requirement to extend the period of data collection (i.e. for a period in excess of 1 calendar year from date of approval), completion of an extension request is required (form RECH-005 available on Research Ethics Committee (Human) portal)
5. In the event of any changes made to the study (excluding extension of the study), completion of an amendments form is required (form RECH-006 available on Research Ethics Committee (Human) portal).
6. Immediate submission (and possible discontinuation of the study in the case of serious events) of the relevant report to RECH (form RECH-007 available on Research Ethics Committee (Human) portal) in the event of any unanticipated problems, serious incidents or adverse events observed during the course of the study.
7. Immediate submission of a Study Termination Report to RECH (form RECH-008 available on Research Ethics Committee (Human) portal) upon expected or unexpected closure/termination of study.
8. Immediate submission of a Study Exception Report of RECH (form RECH-009 available on Research Ethics Committee (Human) portal) in the event of any study deviations, violations and/or exceptions.
9. Acknowledgement that the study could be subjected to passive and/or active monitoring without prior notice at the discretion of Research Ethics Committee (Human).

Please quote the ethics clearance reference number in all correspondence and enquiries related to the study. For speedy processing of email queries (to be directed to Imtiaz.Khan@mandela.ac.za), it is recommended that the ethics clearance reference number together with an indication of the query appear in the subject line of the email.

We wish you well with the study.

Yours sincerely

Govender

Dr S Govender
Chairperson: Research Ethics Committee (Human)

Cc: Department of Research Development
Faculty Manager: BES

Appendix 1: Acknowledgement of conditions for ethical approval

APPENDIX 2: LETTER OF CONSENT AND REAL-TIME DELPHI QUESTIONNAIRE

Dear Participant

You have been invited to an eDelphi panel on possible future scenarios for South Africa's ocean economy towards 2060.

You are invited to add your views and findings on possible future scenarios for South Africa's ocean economy towards 2060. The study has been approved as per the Nelson Mandela University Research and Ethics rules (Ethics Reference no: H20-BES-DEV-043). The real-time Delphi questionnaire is part of my PHD research (Development Studies), which is performed in the context of the strategic role that the ocean economy has towards sustainable development and economic growth for South Africa towards 2060. As an individual with relevant knowledge and experience applicable to the ocean economy, I would appreciate it if you could participate in this real-time Delphi study on certain megatrends, key drivers or enables and wild cards, which may define the future of a sustainable ocean economy for South Africa.

The study has been approved as per the Nelson Mandela University Research and Ethics rules (Ethics Reference no: H20-BES-DEV-043).

The panel/questionnaire consists of four parts. Part 1 is on demographic information, Part 2 identifies six proposed megatrends that have and continue to shape the ocean economy with supporting statements that could either be linked to the social, political, environmental, economic or ethical drivers. This is captured under one query named Part 1 and 2. Part 3 consists of the key enablers or drivers that define the future of the ocean economy and is also captured under a separate query named Part 3. Lastly, Part 4 focuses on the wild cards that have and continue to shape the future of the ocean economy towards 2060.

Participation in this research will also be in line with the following principles:

1. Right to withdraw: Participants have the right to refuse to answer questions and may withdraw from participation at any time.
2. Privacy and anonymity: Steps will be taken to ensure that personal data of participants is at all times secured and not recorded in the research.
3. Feedback: All participants of the study will receive the final and examined research report upon request from Ms Nomtha Hadi or the via the Nelson Mandela University library website.

Please remember to return to the questionnaire often before the closing date. When you return to the questionnaire, you will see how the group's answers have evolved and you may edit your comments in response, no later than the closing date. If you have difficulties, please send your questions to the following email address: Nomtha.hadi@mandela.ac.za

As an expert with relevant knowledge and experience applicable to sustainable ocean economy growth, I would appreciate it if you could participate in this real-time Delphi study on certain megatrends, key drivers or enables and wild cards, which may define the future of a sustainable ocean economy for South Africa.

The questionnaire consists of four parts, Part 1 is on demographic information, Part 2 identified six megatrends that have and continue to shape the ocean economy, Part 3 consists of key enablers or drivers that shape the future of the ocean economy. Finally, Part 4 focuses on the wild cards that have will continue to shape the future of the ocean economy towards 2060. The Likert scale is as follow: Importance (5= most important and 1 = least important) and Probability (5 = high probability and 1= low probability)

Please note that the software supports browsers Microsoft Edge, FireFox and Google Chrome as browsers. The questionnaire will take approximately 45 minutes to complete, Part 1 and 2 (20 -25 minutes), Part 3 (10-15 minutes) and Part 4 (10-15 minutes).

To accept the invitation, please click the link below:

[ACCEPT URL]

To decline the invitation, please click the link below:

[DECLINE URL]

Note that after declining, you will not receive any more e-mail notifications about the panel. If you decline an invitation by accident, you can still accept it by clicking the accept link.

Please notice that the links are personal! Do NOT share them with others.

eDelphi privacy policy is fully GDPR (EU General Data Protection Regulation 2016/679) and US Privacy Law compliant (see https://www.edelphi.org/privacypolicy.page).

Best Regards

Ms Nomtha Hadi

Email: nomtha.hadi@mandela.ac.za

Cell: +27 82 381 3933

PART 1: DEMOGRAPHIC QUESTION		
Please complete the demographics section as this will enable the researcher to cross-tabulate and compare subgroups to see how responses vary between these groups. The table presents the demographic questions, the possible responses, the type of response allowed and the associated coding for post data analysis.		
1.1 Which section(s) of the ocean economy are you or were you mostly involved with?	Harvesting of living resources (fishery etc.) Extraction of non-living resources (oil etc.) Generation of new resources (freshwater) Commerce and trade (transport/tourism etc) Environmental protection Science/Research Innovation and Technology Education and Training Other (Specify) *Drop down list (one choice)*	1 2 3 4 5 6 7 8
1.2 How many years of experience do you have in the ocean economy?	1 - 3 years 3 – 5 years 6-10 years 10- 15 years 15 – 20 years 20- 25 years 30 years and more Other (Specify) *Drop down list (one choice)*	1 2 3 4 5 6 7 8
1.3 Gender	Male Female *Drop down list (one choice)*	
1.4 Age	20 - 29 years 30 - 39 years 40 - 49 years 50 - 59 years 60 - 70 years 70 years and older *Drop down list (one choice)*	

<table>
<tr><td>1.5 Education background</td><td>Natural Science
Business, Finance and Economics
Construction / Built Environment
Law
General Management
Engineering (Mechanical, Civil and Computer Science)
Arts
Humanities
Other (Specify)
Drop down list (one choice)</td><td></td></tr>
<tr><td>1.6 Operating Region (s)</td><td>North America
South America
Europe
Middle East
North Africa
Sub-Saharan Africa
Asia
Other (Specify)
Drop down list (one choice)</td><td></td></tr>
<tr><td colspan="3">PART 2: MEGATRENDS IN THE OCEAN ECONOMY</td></tr>
<tr><td colspan="3">2.1 Proposed Megatrend 1: Meeting future energy demands through sustainable ocean industries. Please remember that a score of 5 indicates most importance or high probability of occurrence, while a score of 1 indicates least importance or low probability of occurrence.</td></tr>
<tr><td rowspan="3">Towards 2060 – South Africa will be able to meet growing energy demands safely and efficiently through sustainable mechanical and thermal ocean energy industries.</td><td>Using a collective Likert score (rate the importance of this megatrend in defining the future of South Africa’s ocean economy towards 2060)
1 2 3 4 5</td><td>Using a collective Likert score (rate the probability of this megatrend in defining the future of South Africa’s ocean economy towards 2060)
1 2 3 4 5</td></tr>
<tr><td colspan="2">The South African regulatory (taking into consideration current policies and legislation) environment will stimulate such a trend.
Yes or No
Additional comments:</td></tr>
<tr><td colspan="2">The growth in the South African population will drive the increasing demand for energy resources necessitating the country to explore ocean energy resources.
Yes or No
Additional comments:</td></tr>
</table>

<table>
<tr><td rowspan="4"></td><td colspan="2">Environmental drivers and programmes in South Africa will ensure that alternative energy initiatives do not negatively affect the ocean economy leading towards the degradation and depletion of ocean resources</td></tr>
<tr><td colspan="2">Yes or No
Additional comments:</td></tr>
<tr><td colspan="2">Economic drivers associated with increased investments and innovative yet affordable energy initiatives in South Africa will stimulate such a trend.
Yes or No
Additional comments:</td></tr>
<tr><td colspan="2">Decision on megatrend: Keep the Formulation or Discard the Formulation
Keep or Discard
Additional comments</td></tr>
<tr><td colspan="3">2.2. Proposed Megatrend 2: Smart population driving ocean economy development and improved social standards (smart populations refers to people that are advanced in science and technology promoting ocean economy development and improving the lives of citizens through technology and integrated ocean industry platforms)</td></tr>
<tr><td rowspan="5">Towards 2060, South Africa will have a smart population driving ocean economy development and improved social standards.</td><td>Using a collective Likert score (rate the importance of this megatrend in defining the future of South Africa’s ocean economy towards 2060)
1 2 3 4 5</td><td>Using a collective Likert score (rate the probability of this megatrend in defining the future of South Africa’s ocean economy towards 2060)
1 2 3 4 5</td></tr>
<tr><td colspan="2">The migration patterns towards coastal cities will promote education and training on the ocean economy and increased skills development for the future.
Yes or No
Additional comments:</td></tr>
<tr><td colspan="2">Economic drivers associated with increased investment on technology and skills development initiatives in South Africa will stimulate such a trend.
Yes or No
Additional comments:</td></tr>
<tr><td colspan="2">Ethical drivers in South Africa associated with reduced corruption and adequately skilled and competent people championing the ocean economy will stimulate such a trend.
Yes or No
Additional comments:</td></tr>
<tr><td colspan="2">Ocean economy industries and role-players within South Africa will innovate and increase initiatives towards technological catch-up and the absorption of knowledge on sustainable ocean economies.
Yes or No
Additional comments:</td></tr>
</table>

<table>
<tr><td rowspan="2"></td><td colspan="2">The South African regulatory environment (policies and legislation) will stimulate such a trend?
Yes or No
Additional comments:</td></tr>
<tr><td colspan="2">Decision on megatrend: Keep the formulation or discard the formulation
Keep or Discard
Additional comments</td></tr>
<tr><td colspan="3">2.3 Proposed Megatrend 3: Food security and improved standards of living through technological breakthroughs</td></tr>
<tr><td rowspan="6">Towards 2060, technological breakthroughs in South Africa will promote food security, sustainable extraction and consumption levels on ocean resources and improved standards of living.</td><td>Using a collective Likert score (rate the importance of this megatrend in defining the future of South Africa’s ocean economy towards 2060)
1 2 3 4 5</td><td>Using a collective Likert score (rate the probability of this megatrend in defining the future of South Africa’s ocean economy towards 2060)
1 2 3 4 5</td></tr>
<tr><td colspan="2">The high rate of urbanisation or increased population trends in South Africa will lead to increased economic activities and technological breakthroughs that will stimulate demand for food from ocean resources and improved standards of living for most of the population.
Yes or No
Additional comments:</td></tr>
<tr><td colspan="2">Opportunities from biotechnology, growing reliance on digital and autonomous systems will promote sustainable food sources and improve standards of living.
Yes or No
Additional comments:</td></tr>
<tr><td colspan="2">Increase investments in South Africa on aquaculture and food processing facilities will promote employment creation and sufficient fish / food resources from ocean resources.
Yes or No
Additional comments:</td></tr>
<tr><td colspan="2">The South African regulatory environment (policies and legislation) will stimulate such a trend?
Yes or No
Additional comments:</td></tr>
<tr><td colspan="2">Decision on megatrend: Keep the formulation or discard the formulation
Keep or Discard
Additional comments</td></tr>
<tr><td colspan="3">2.4 Proposed Megatrend 4: Resilient ocean economies with increased knowledge and labour productivity across all ocean industries</td></tr>
</table>

<table>
<tr><td rowspan="6">Towards 2060, South Africa will have an increasingly knowledge-intensive sector, characterised by an increased level of specialisation and labour productivity that promotes a resilient ocean economy.</td><td>Using a collective Likert score (rate the importance of this megatrend in defining the future of South Africa’s ocean economy towards 2060)
1 2 3 4 5</td><td>Using a collective Likert score (rate the probability of this megatrend in defining the future of South Africa’s ocean economy towards 2060)
1 2 3 4 5</td></tr>
<tr><td colspan="2">Ocean industries or activities in South Africa such as fishing, tourism and transportation will promote employment creation, increased education, training and skills development for the future and increased knowledge on all ocean industries.
Yes or No
Additional comments:</td></tr>
<tr><td colspan="2">Through increased knowledge, South Africa will reduce environmental challenges that have major implications for global biodiversity, infrastructure, human health and wellbeing and the productivity of ocean industries.
Yes or No
Additional comments:</td></tr>
<tr><td colspan="2">From a technological perspective, as robots and artificial intelligence take on more jobs within the ocean economy, costs should decrease, and more people will be able to afford better products and services.
Yes or No
Additional comments:</td></tr>
<tr><td colspan="2">The South African regulatory environment (policies and legislation) will stimulate such a trend?
Yes or No
Additional comments:</td></tr>
<tr><td colspan="2">Decision on megatrend: Keep the formulation or discard the formulation
Keep or Discard
Additional comments</td></tr>
<tr><td colspan="3">2.5 Proposed Megatrend 5: Antifragile global trade that empowers local communities, youth and women</td></tr>
<tr><td rowspan="2">Towards 2060, South Africa will have antifragile global trade characterised by an increased level of involvement of local communities, youth and women in the design and implementation of a sustainable ocean economy.</td><td>Using a collective Likert score (rate the importance of this megatrend in defining the future of South Africa’s ocean economy towards 2060)
1 2 3 4 5</td><td>Using a collective Likert score (rate the probability of this megatrend in defining the future of South Africa’s ocean economy towards 2060)
1 2 3 4 5</td></tr>
<tr><td colspan="2">Accelerated scientific and technological breakthroughs and improved human conditions for the youth and woman in South Africa will promote empowered local economies.
Yes or No
Additional comments:</td></tr>
</table>

<table>
<tr><td rowspan="4"></td><td colspan="2">A reduction in the dropout rate in the education system from the youth reduced reliance on drugs will empower local communities and assist with a bigger skills pool for promoting antifragile global trade and ocean industries.
Yes or No
Additional comments:</td></tr>
<tr><td colspan="2">In ensuring a sustainable ocean economy, South Africa will have sufficient investment to promote adequately skilled women and youth that will be competent in championing global trade.
Yes or No
Additional comments:</td></tr>
<tr><td colspan="2">The South African regulatory (taking into consideration current policies and legislation) environment will stimulate such a trend.
Yes or No
Additional comments:</td></tr>
<tr><td colspan="2">Decision on megatrend: Keep the formulation or discard the formulation
Keep or Discard
Additional comments</td></tr>
<tr><td colspan="3">2.6 Proposed Megatrend 6: Economic impact of disease events (COVID-19)</td></tr>
<tr><td rowspan="4">Towards 2060, South Africa will be better prepared in disease management and prevention, which will assist in reducing the impact epidemics have on people’s health and livelihoods far beyond the direct effects of the outbreak in the sectors of the countries where the disease occurs. Thus, reducing the economic and social impact of disease events for the ocean economy, which is a global industry.</td><td>Using a collective Likert score (rate the importance of this megatrend in defining the future of South Africa’s ocean economy towards 2060)
1 2 3 4 5</td><td>Using a collective Likert score (rate the probability of this megatrend in defining the future of South Africa’s ocean economy towards 2060)
1 2 3 4 5</td></tr>
<tr><td colspan="2">Increasing migration patterns and highly dense urban areas in South Africa will make it difficult for the country to reduce the threat of new and re-emerging diseases and immune microorganisms in ocean related industries.
Yes or No
Additional comments:</td></tr>
<tr><td colspan="2">Advances in artificial intelligence, robotics and other technologies will fundamentally change employment in some ocean economy sectors and create new opportunities to safely and efficiently explore, alternative work situations or solutions.
Yes or No
Additional comments:</td></tr>
<tr><td colspan="2">Increased investment in ocean economy industries will lead to effective solutions, better connectivity for all stakeholders and prompt communication on disease events (for example, rollout of the vaccine to most of the population).
Yes or No
Additional comments:</td></tr>
</table>

	With the nature of work changing in South Africa and an increased remote world of work, this reduces carbon emission from travelling and positively impacting the ocean environment. Yes or No Additional comments:
	The South African regulatory (taking into consideration current policies and legislation) environment will stimulate such a trend. Yes or No Additional comments:
	With many countries implementing lockdown and restricting fishing activities and cruise operators / shipping activities in their waters, living ocean resources show growth potential during downturns as it has been previously experienced during World War ll. Yes or No Additional comments:
	Decision on megatrend: Keep the formulation or discard the formulation Keep or Discard Additional comments
PART 3: KEY ENABLERS OR DRIVER(S) THAT WILL SHAPE THE FUTURE OF SOUTH AFRICA'S OCEAN ECONOMY TOWARDS 2060 *** Rate the importance of the driver in shaping the future of the ocean economy (5 – Very Important, 4 – Important, 3 – Neutral, 2 – Less Important and 1 – Not Important)**	
3.1 Social drivers are associated with employment creation. Ocean economy will ensure alternative employment, energy sources and promote degradation of resources.	Rate the importance of this driver in shaping the future of the ocean economy 1 2 3 4 5 Additional comments: ____
3.2 Technological drivers (for example, new workflows, automated vessels and new logistical processes) will be successfully utilised to drive sustainable process innovations in the ocean economy.	Rate the importance of this driver in shaping the future of the ocean economy 1 2 3 4 5 Additional comments: ____
3.3 Economic drivers associated with increased investment, partnerships/ privatisation and innovative funding	Rate the importance of this driver in shaping the future of the ocean economy 1 2 3 4 5 Additional comments: ____

solutions (namely, crowdfunding) will drive advanced ocean economies in the African continent and globally.	
3.4 Environmental drivers associated with climate change and how countries respond to challenges posed by ocean acidification, will change the way South Africa produces and uses natural resources and energy from the ocean, and the way the land resources are managed as well.	Rate the importance of this driver in shaping the future of the ocean economy 1 2 3 4 5 Additional comments: ____
3.5 Political drivers associated with credible leaders and government structures will promote sustainable ocean economies based on decisions that benefit countries and not individuals.	Rate the importance of this driver in shaping the future of the ocean economy 1 2 3 4 5 Additional comments: ____
3.6 Legal drivers associated with sustainable ocean economy decision-making processes that are transparent, participative, and accountable at all times and under legal and societal scrutiny).	Rate the importance of this driver in shaping the future of the ocean economy 1 2 3 4 5 Additional comments: ____
3.7 Ethical drivers associated with ensuring that adequately skilled and competent people are allowed to champion all the key ocean economy sectors will promote a sustainable ocean economy that ensures the protection, preservation and conservation of the ocean space so as to	Rate the importance of this driver in shaping the future of the ocean economy 1 2 3 4 5 Additional comments: ____

protect endangered ecosystems and species.	
PART 4: WILD CARDS THAT HAVE DISRUPTED AND CHANGED THE OCEAN ECONOMY *** Rate the importance of the wild card in shaping the future of the ocean economy (1 – Not Important, 2 - Less Important, 3 - Neutral, 4 – Important and 5 – Very Important) and discuss its impact on the ocean economy.**	
4.1 Higher pollution possible through oil spills from ships and other land-based sources.	Rate the importance of the wild card and its impact on the future of the ocean economy 1 2 3 4 5 Impact comments: ______________________________
4.2 The widening gap between rich and poor will make ocean economy industries and sectors exclusive leading to potential clashes between various economic classes.	Rate the importance of the wild card and its impact on the future of the ocean economy 1 2 3 4 5 Impact comments: ______________________________
4.3 Disruptive technologies (for example, artificial intelligence, big data, blockchain) will drive academic programmes, research and business innovation cycles within the ocean economy.	Rate the importance of the wild card and its impact on the future of the ocean economy 1 2 3 4 5 Impact comments: ______________________________
4.4 High resolution ocean floor mapping will promote an overall understanding and monitoring of environmental changes owing to climate change and pollution within the ocean environment.	Rate the importance of the wild card and its impact on the future of the ocean economy 1 2 3 4 5 Impact comments: ______________________________
4.5 Smart shipping and ports, smart fish extraction and processing facilities will reduce the employment opportunities identified within the ocean economy	Rate the importance of the wild card and its impact on the future of the ocean economy 1 2 3 4 5 Impact comments: ______________________________

4.6 Traceability of fish stocks and fish products will combat illegal, unreported and unregulated (IUU) activities and reduce crime leading to improve the governance required to preserve and rebuild fish stocks.	Rate the importance of the wild card and its impact on the future of the ocean economy 1 2 3 4 5 Impact comments: ____
4.7 Ethical wild cards linked to increased corruption and terrorism will create instability and dysfunctional ocean economies.	Rate the importance of the wild card and its impact on the future of the ocean economy 1 2 3 4 5 Impact comments: ____

APPENDIX 3: INTERVIEW GUIDE AND QUESTIONS

Faculty of Economic and Management Sciences

Department of Development Studies

Date: July 2021

BACKGROUND TO THE STUDY, IDENTIFIED MEGATRENDS AND INTERVIEW GUIDE (PHD: DEVELOPMENT STUDIES RESEARCH – N HADI - JULY 2021)

1. BACKGROUND

The topic is of significance owing to the growing global focus on the ocean economy. The African Union Agenda for 2063 (African Union, 2013) is aimed at building and accelerating the implementation of past and existing continental initiatives for growth and sustainable development. For the ocean economy, growth and sustainable development is further elaborated in the overarching vision of the 2050 Africa Integrated Maritime (AIM) Strategy (Africa Union, 2014). The strategy fosters increased wealth creation from Africa's ocean and coast by developing a sustainable thriving ocean economy in a secure and environmentally sustainable manner (Africa Union, 2013). Human aspirations and economic growth continue to exert pressure on the ocean and the marine ecosystem and, therefore, constitute serious challenges for sustaining growth within the six sectors highlighted in Operation Phakisa (2014) as being essential for growing a sustainable future for South Africa's ocean economy. The study aims to bridge the gap from previous research initiatives that failed to obtain a coherent picture of the likely future of the ocean economy analysing all six key sectors (namely, marine transport, offshore oil and gas exploration, fisheries and aquaculture, marine protection services and ocean governance, small harbours development and coastal and marine tourism) while taking into consideration the various social, technological, economic, environmental, political, legislative and ethical factors influencing the growth of the ocean economy.

2. IDENTIFIED MEGATRENDS AND PROPOSED SCENARIOS

Megatrends are the paradigm shifts happening at the intersection of cultural, social, economic, political, technological, regulatory and market forces (The Economist, 2015). Megatrends can help businesses, governments and ordinary citizens living in coastal areas or connected to the ocean environment prepare for an unpredictable future through the shared understanding of potential scenarios. Six megatrends were identified in the study and confirmed though a quantitative and qualitative research approach using the real-time Delphi platform. The identified megatrends and drivers are summarised in Table 1 and form the basis for the proposed four scenarios for South Africa's ocean economy towards 2060.

Table 1: Proposed four scenarios for South Africa's ocean economy towards 2060

Megatrend 1: Future energy demands being met through sustainable ocean industries **Key ocean economy sector(s) affected: All**	
Main Driver (s) - Linked to environmental scanning process	**Formulation on megatrend and decision based on real-time Delphi results**
Social drivers associated with population growth trends, employment creation needs as well as environmental drivers that speak to climate change and ensure that alternative energy initiatives do not deplete natural resources or harm the environment. Economic drivers associated with increased investments for alternative energy sources, climate change mitigation, research/strategies and innovative, yet affordable, energy initiatives in South Africa remained key.	*Towards 2060, South Africa would be able to meet growing energy demands safely and efficiently through sustainable mechanical and thermal ocean energy industries. Keep the formulation = Yes
Megatrend 2: Smart population driving ocean economy development and improved social standards **Key ocean economy sector(s) affected: All**	
Social drivers are associated with migration patterns towards coastal cities, promoting education and training as well as skills development for the future. Technological drivers are associated with increased reliance on digital and autonomous systems. Economic drivers are associated with (investments and employment creation. Political and legal drivers are associated with governments adopting friendlier policies that assist with technological catch-up and the absorption of knowledge.	*Towards 2060, South Africa would have a smart population driving ocean economy development and improved social standards. Keep the formulation = Yes
Megatrend 3: Food security and improved standards of living being met through technological breakthroughs **Key ocean economy sector(s) affected: FA, MT, MPSOG, SHD and CMT**	
Social drivers are associated with a high rate of urbanisation or increased population trends that leads to increase economic activity and consumption levels on ocean resources, employment creation, education and training as well as skills development for the future. Economic drivers are associated with (investment in aquaculture, food security, processing and employment creation. Environmental drivers are associated with the ocean environment, which is facing unprecedented change as a result of direct human activity and climate change.	*Towards 2060, Technological breakthroughs in South Africa would promote food security, sustainable extraction and consumption levels on ocean resources and improved standards of living. Keep the formulation = Yes
Megatrend 4: Resilient ocean economies with increased knowledge and labour productivity being achieved across all ocean industries **Key ocean economy sector(s) affected: All**	
Technological drivers associated with increasing reliance on satellites and data sharing, advances in autonomy and other technologies are expected to fundamentally change employment in some marine sectors, and create new opportunities to safely and efficiently explore, monitor	*Towards 2060, South Africa would have an increasingly knowledge-intensive sector, characterised by an increased level of

and work at sea. Ethical drivers associated with ensuring a sustainable ocean economy entail protection, preservation and conservation of the ocean space so as to protect endangered ecosystems and species. As a result, it is critically important to ensure that adequately skilled and competent people are allowed to champion all the key priority sectors.	specialisation and labour productivity that promotes a resilient ocean economy Keep the formulation = Yes
Megatrend 5: Antifragile global trade empowering local communities, youth and women **Key ocean economy sector(s) affected: All**	
Social drivers associated with promoting education and training as well as skills development for the future for all. Economic drivers are associated with promoting and incentivising investments and long-term employment opportunities that empowers local communities, youth and women. Political drivers associated with governments must adopt friendlier policies that assist with technological catch-up and the absorption of knowledge for all and accelerate the implementation of preferential policies.	*Towards 2060, South Africa would have antifragile global trade characterised by an increased level of involvement of local communities, youth and women in the design and implementation of a sustainable ocean economy. Keep the formulation = Yes
Megatrend 6: Economic impact of disease events (COVID-19) **Key ocean economy sector(s) affected: All**	
Economic drivers are associated with investments and establishment of industries which, in turn, affect the state and capacity of countries to provide for themselves during the time of emergencies. Technological drivers are associated with big data analytics, digitalisation and more advanced communications will lead to better connectivity and prompt communication on disease events and solutions.	*Towards 2060, South Africa would be better prepared in disease management and prevention, which would assist in reducing the impact epidemics had on people's health and livelihoods thus reducing the economic and social impact of disease events for the ocean economy, which is a global industry. Keep the formulation = Yes

*Key sectors are abbreviated as follows if the megatrend does not apply to all. Marine Transport = MT, Offshore Oil and Gas Exploration = OOGE, Fisheries and Aquaculture = FA, Marine Protection Services and Ocean Governance = MPSOG, Small Harbours Development = SHD and Coastal and Marine Tourism = CMT

Proposed scenarios:

The explorative scenarios present possible future scenarios with the present situation, informed by a literature review, the environmental scanning process and the real-time Delphi results, as a point of departure towards a future for South Africa's ocean economy. The four corners of the basic scenario matrix for South Africa's ocean economy, as presented in Figure 1, represent four possible logical futures that can be explored. The horizontal axis of the scenario matrix represents socio-ecological resilience, which is defined as the capacity to adapt or transform in the face of change in social-ecological systems (this was linked to pandemic, education, environmental and ethical factors in ocean economy development). The vertical axis in the proposed scenario matrix represents the level at which innovations in ocean economy sectors embed themselves in promoting sustainable ocean economies, resulting in high levels of productivity, inclusiveness and economic growth for South Africa towards 2060.

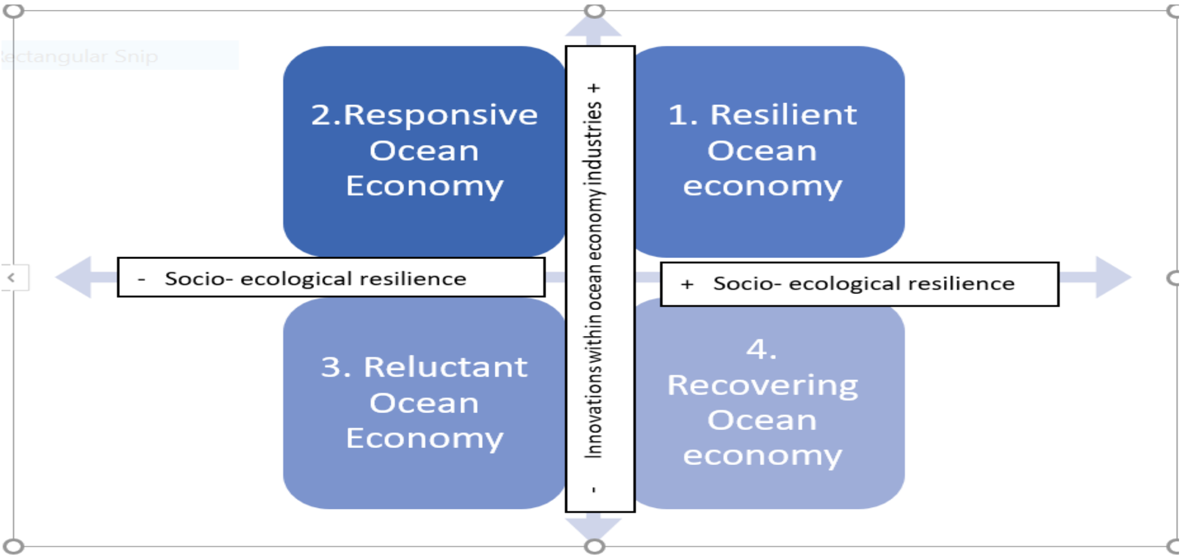

Figure 1: Four corners of basic scenario matrix for South Africa's ocean economy

3. INTERVIEW GUIDE – CONDUCTED VIA TEAMS/ ZOOM

1. From the megatrends shared in the introductory paragraph, which trends do you view as important in shaping and changing the South African ocean economy? Please elaborate.

2. Which of the proposed scenarios can be realistically possible in developing a sustainable and an inclusive ocean economy for South Africa towards 2060?

3. Do the necessary capacities and support exist in the country, and which role-players can effectively collaborate in the implementation of the possible future(s) highlighted in the previous question?

4. Are there any additional comments or areas that you would like to highlight as a driving factor towards a sustainable ocean economy for South Africa towards 2060?

APPENDIX 4: TURNITIN REPORT

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